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IVY.

BY GRANT ALLEN.

THOUGH every one of us has been perfectly familiar with common ivy from his boyhood, upward, I wonder how many people have ever noticed its pretty bunches of thickly-clustered, pale yellowish-green flowers that form such large and prominent masses in the early autumn. They are just now in full blossom, and are attracting, as usual, the flies and bees in great numbers to their abundant store of easily-accessible honey. Let us stop for a while beside some knotted stem that clambers close against some low wall, and examine this old, familiar favourite in the new light cast upon it by the discoveries of modern biological science.

Ivy is a native English evergreen creeper, one of the very few large-leaved evergreens really indigenous to our islands; for though the laurels, and aucubas, and laurustinuses, and rhododendrons of our shrubberies have made us now perfectly at home among the class by naturalisation, yet almost all our true British evergreens are more or less needle-leaved conifers, such as the Scotch fir, the yew-tree, and the juniper. Holly, an undoubted native of England, and box, which is very probably an introduced alien, are its chief compeers in this respect. In its truly wild state, the lower branches of ivy creep along the soil, while the main stems climb up trees, walls, or rocks, to which they adhere by means of small fibrous root-like excrescences. This is one out of the many ways adopted by comparatively feeble plants to raise themselves, half parasitically (so far as support alone is concerned, I mean) up the stout trunks of other and more sturdy woodland competitors. Compare it, in this respect, with the straggling arched-branches of the common blackberry bramble, loosely festooned by means of their curved and hooked prickles over the blackthorns and May-bushes in the wastes and hedges; or with the little sucker-like supports of the virginia creeper, clinging fast to the tiny crannies and asperities of a brick wall here in England, as it clings in its native woodlands to the chinks and rugosities in the bark of trees; or with the twining tendrils of the pea, really abortive leaflets, that twist twice or thrice or even oftener round the twigs and branchlets of the supporting bushes; or with the curling leaf-stalks of the canary creeper, where the petiole of a true and active leaf performs the same clasping function. In every case, the end to be attained is the same—the plant endeavours to raise itself by means of some tree, shrub, or bush, above the competing mass of foliage on the ground below, and to reach the open air and free sunlight overhead; but by what an immense variety of means it attains in various cases this desired result! Any trick of habit, be it hooked hair (as in goosegrass), or twining stems (as in convolvulus), or mouth-like suckers (as in dodder), or twisted leaf-stalk (as in clematis), that happens to aid in this object, is immediately seized upon by natural selection, and developed and encouraged into an organic peculiarity of the whole species. In our little English flora alone, to go no further, it is an interesting study to look at all the cases above enumerated, side by side with those of bryony, tamus, wild madder, dog-rose, cinquefoil, vetches, hop, and periwinkle, whose diverse modes of obtaining this single end should be noticed in detail by the country walker.

The leaves of ivy form by far the most conspicuous part of the plant to most ordinary outside observers. Their shape is very characteristic, so much so that the epithet "ivy-leaved" has been given to many other plants, such as the ivy-leaved ranunculus, the ivy-leaved veronica, and the ivy-leaved toadflax. It is a noteworthy fact, too, that all the plants possessing foliage of this peculiar broadly-lobed form are trailers or climbers; and in most of them the leaves habitually form a single layer—lie one deep only—over the wall, or tree-trunk, or soil on which the plant is creeping. In short, this form of leaf seems specially adapted for climbing plants; its angles dovetail neatly into one another, and the tip of each fills the hollow at the stalk of its neighbour, so that every leaf obtains the full benefit of the sunlight on all its parts, without interfering with the equal illumination of its like-minded fellows. I do not say that this is the only, or even the best, way for obtaining that result; but it is one way, and a sufficient way; and that is all that natural selection can, as a rule, succeed in securing. One has only to look at a mass of wild ivy creeping up a wall or tree in order to see how admirably the whole body drapes the entire space it covers, leaving very few interstices, yet seldom casting a shadow over any part of its own surface. I say "wild ivy," because many of the cultivated exotic varieties in our gardens, being grown for the sake of their luxuriant leafage alone, under artificial conditions, in richly-manured soil, produce copious masses of over-lapping leaves very different from the native parsimony of the indigenous field species.

Observe, however, that the leaves upon the upper flowering branches are extremely unlike in form to those which cover the naked wall with their bright verdure. These upper shoots rise freely into the air, and have rounded or oval leaves, not at all "ivy-shaped," disposed pretty equally on every side, so as to catch the open sunlight into which they have raised themselves. The upper leaves often somewhat resemble lime-leaves or laurustinus-leaves in general outline; and they clearly show how much the shape of the foliage depends upon the surrounding conditions of air and sunshine. Where these conditions of growth are supplied one-sidedly, as on the wall, the foliage is all turned outward, and so shaped as to economise every portion; where they are equally diffused all round, the foliage grows out alike on every side, and avoids mutual interference by its spiral arrangement along the central axis. Very starved ivy, on a dry wall, has usually very reduced and deeply-divided leaves, with finger-like lobes; very luxuriant ivy, when it overtops its support, has usually very full and

rounded leaves, often with no perceptible lobes, and sometimes almost circular in shape.

Why is ivy evergreen? I believe for this reason. It is not a plant of very cold countries: it won't grow in North Germany, Russia, or Siberia, and Britain is almost its northern limit. Southern Europe, Northern Africa, and Western Asia are its favourite dwelling-places. In the wild state, it is chiefly a woodland plant, clambering up the trunks of trees in the great forests. Hence it is shaded during a greater part of the year by the leaves on the deciduous trees, and it has to lay by the material for its growth and flowering and fruiting in autumn, winter, and spring, when the boughs above have lost their foliage. As a matter of fact, even in England, its growth is most luxuriant in late autumn, it flowers in October and November, it goes on putting forth fresh leaves and wood as long as the season permits it, it ripens its berries through the winter, and it begins leafing again as soon as the spring is once more with us. In more southern countries it works uninterruptedly from October to May, and lies by almost dormant during the long dry summer. It is thus essentially a winter plant, and that, I take it, is why its leaves are evergreen.

The curious and pretty yellowish green flowers are worth a moment's consideration. They have each five small petals, and five stamens, with a very broad disk in the middle, surrounding the central stigma. This disk secretes quantities of honey, which stands in little drops upon its surface, and can be readily distinguished with the naked eye and tested with the tongue. The honey attracts large numbers of flies, bees, and wasps, but especially the hive-bee, which, in England at least, is certainly (so far as I have noted) the chief fertiliser, though Continental observers give this *rôle* in Italy and France to the flies and beetles. The stamens mature first, so as to prevent fertilisation from the same flower; and in this state the petals are simply expanded, and the honey abundant. Bees visiting such flowers carry away pollen on their heads for the next they visit. Afterwards the blossoms reach their second state, the petals roll backward, the stigma ripens, and the honey decreases greatly in quantity. Bees visiting these maturer flowers rub off upon them the pollen they have brought from the ripe stamens of neighbours in their first state. Inconspicuous as the blossoms are, individually, their habit of massing in large clusters, and their smell of honey, seem to stand them in good stead of brilliant petals; for they are much resorted to by all the insects that still fly about in late autumn.

After fertilisation, the berries begin to grow as best they may through the winter; but they do not ripen or assume their bluish-black tint till the next year. They are then much eaten, and their seeds dispersed, by birds, which find these dusky hues very attractive, as in the sloe, the blackberry, the whortleberry, and the privet. A southern variety in our gardens, however, has prettier berries of a bright yellow colour.

OUR TWO BRAINS.

By Richard A. Proctor.

(*Continued from p.* 310.)

BUT perhaps the most remarkable illustration of a double life is one which was brought before the notice of the scientific world a few years ago. I refer to the case published by Dr. Mesnet, and mentioned in Dr. Huxley's remarkable lecture at Belfast on the hypothesis that animals are or may be automata. I do not purpose to quote Huxley's account in full, as no doubt many of my readers have already seen it, but the following facts are necessary to show the bearing of the case on Sequard's theory: "A sergeant of the French army, F——, twenty-seven years of age, was wounded at the battle of Bazeilles, by a ball which fractured his left parietal bone. He ran his bayonet through the Prussian soldier who wounded him, but almost immediately his right arm became paralysed; after walking about two hundred yards his right leg became similarly affected, and he lost his senses. When he recovered them, three weeks afterwards, in hospital at Mayence, the right half of the body was completely paralysed, and remained in this condition for a year. At present, the only trace of the paralysis which remains is a slight weakness of the right half of the body. Three or four months after the wound was inflicted, periodical disturbances of the functions of the brain made their appearance, and have continued ever since. The disturbances last from fifteen to thirty hours, the intervals at which they occur being from fifteen to thirty days. For four years, therefore, the life of this man has been divided into alternating phases, short abnormal states intervening between long normal states."

It is important to notice here that although this case somewhat resembles that of Brown-Sequard's two-lived boy, we have in the soldier's case a duality brought about by a different cause, an accident affecting the *left* side of the head—that side, as we shall presently see, which is regarded as ordinarily if not always the seat of chief intellectual activity. The soldier's right side was paralysed, confirming the theory that so far as the bodily movements are concerned the left brain chiefly rules the right-hand organs of the body, and *vice versâ*. But the man had recovered from his paralysis, so that either the left side of the brain had been partially restored or else the right brain had acquired the power of directing the movements of the right-hand organs. But the periodical disturbances came on three or four months after the wound was inflicted, that is, more than half a year before the paralysis disappeared. We have, then: 1st, three weeks of unconsciousness, during which we may suppose that the left side of the brain was completely stunned (if we may apply to the brain an expression properly relating to the condition of the man); secondly, we have three months during which the man was conscious, and in his normal mental condition, but paralysed; thirdly, we have more than half a year during which a double mental life went on, but the left side of the brain was still so far affected that the right side of the body was paralysed; and lastly, we have more than three years of this double mental life, the bodily functions in the man's normal life being, it would appear, completely restored.

Assuming, then, Wigan's theory for the moment, we have to inquire whether the man's normal condition implies the action of the uninjured right brain, or of the restored left brain, and also to determine whether the recovery from paralysis has resulted from a more complete restoration of the left brain, or from the right brain having acquired a power formerly limited to the left brain. The fact that the man's normal mental condition returned as soon as consciousness was restored does not show that this condition depends on the action of the left brain, for in the unconscious state both brains were at rest. Rather it might seem to imply that the right brain was the brain active in the normal mental state, for the continued paralysis of the right side showed that the left brain was not completely restored. Yet it has been so clearly shown by other and independent researches that the left brain is the chief seat of intellectual activity that we seem forced to

adopt the opinion that this man's normal condition depends on the action of the left brain. And we may perhaps assume, from the length of time during which the right side remained paralysed after the left brain had resumed a portion of its functions, that the other portion—the control of the right-hand organs—has never been recovered at all by the left brain, but that the right brain has acquired the power, a result which, as we shall presently see, accords well with experience in other cases.

It would almost seem, on Wigan's hypothesis—though I must admit that the hypothesis does not explain all the difficulties in this very singular case—that the right brain having assumed one set of functions belonging to the left, from time to time tries, as it were, to assume also another set of functions belonging to the left—viz. the control of mental operations, the weakened left brain passing temporarily into unconsciousness. The matter is, however, complicated by peculiarities in the bodily state, and in sensorial relations during the abnormal condition. The whole case is, in fact, replete with difficulties, as Professor Huxley well points out,* and it seems to me these difficulties are not much diminished by Wigan's theory.

Let us consider some of the facts of the man's twofold life:—"In the periods of normal life the ex-sergeant's health is perfect; he is intelligent and kindly, and performs satisfactorily the duties of a hospital attendant. The commencement of the abnormal state is ushered in by uneasiness and a sense of weight about the forehead, which the patient compares to the constriction of a circle of iron; and after its termination he complains for some hours of dulness and heaviness of the head. But the transition from the normal to the abnormal state takes place in a few minutes, without convulsions or cries, and without anything to indicate the change to a bystander. His movements remain free and his expression calm, except for a contraction of the brow, an incessant movement of the eyeballs, and a chewing motion of the jaws. The eyes are wide open, and their pupils dilated. If the man happens to be in a place to which he is accustomed he walks about as usual; but if he is in a new place, or if obstacles are intentionally placed in his way, he stumbles gently against them, stops, and then, feeling over the objects with his hands, passes on one side of them. He offers no resistance to any change of direction which may be impressed upon him, or to the forcible acceleration or retardation of his movements. He eats, drinks, smokes, walks about, dresses and undresses himself, rises and goes to bed at the accustomed hours. Nevertheless, pins may be run into his body, or strong electric shocks sent through it without causing the least indication of pain; no odorous substance, pleasant or unpleasant, makes the least impression; he eats and drinks with avidity whatever is offered, and takes asafœtida, or vinegar, or quinine, as readily as water; no noise affects him; and light influences him only under certain conditions. Dr. Mesnet remarks that the sense of touch alone seems to persist, and indeed to be more acute and delicate than in the normal state; and it is by means of the nerves of touch, almost exclusively, that his organism is brought into relation with the outer world."

Such are the general phenomena presented by this curious case. As respects the details of the man's behaviour under particular circumstances, I refer the reader to Professor Huxley's paper in the *Fortnightly Review* for November, 1874. But one peculiarity is so noteworthy, and, rightly understood, gives so special an interest to Wigan's hypothesis, that I must quote it at length, together with the significant remarks with which Professor Huxley introduces the subject. "Those," he says, "who have had occasion to become acquainted with the phenomena of somnambulism and mesmerism, will be struck with the close parallel which they present to the proceedings of F. in his abnormal state. But the great value of Dr. Mesnet's observations lies in the fact that the abnormal condition is traceable to a definite injury of the brain, and that the circumstances are such as to keep us clear of the cloud of voluntary and involuntary fictions, in which the truth is too often smothered in such cases. In the unfortunate subjects of such abnormal conditions of the brain, the disturbance of the sensory and intellectual faculties is not unfrequently accompanied by a perturbation of the moral nature which may manifest itself in a most astonishing love of lying for its own sake. And in this respect, also, F.'s case is singularly instructive; for, although in his normal state he is a perfectly honest man, in his abnormal condition he is an inveterate thief, stealing and hiding away whatever he can lay hands on, with much dexterity, and with an absurd indifference as to whether the property is his own or not. Hoffmann's terrible conception of the "Doppelt-gänger" is realised by men in this state, who live two lives, in the one of which they may be guilty of the most criminal acts, while in the other they are eminently virtuous and respectable. Neither life knows anything of the other. Dr. Mesnet states that he has watched a man in his abnormal state elaborately prepare to hang himself, and has let him go on (!) "until asphyxia set in, when he cut him down. But, on passing into the normal state, the would-be suicide was wholly ignorant of what had happened."

If Wigan and Sequard are right in regarding the changes of opinion with which most of us are familiar as differing only in degree from the duality of a lunatic's mind who has sane and insane periods, and mental indecision as differing only in degree from the case of a lunatic who "is of two minds," knowing that what he says is insane, a curious subject of speculation arises in the consideration of the possible duality of the moral nature. The promptings of evil, and the voice of conscience resisting these promptings, present themselves as the operation of the two brains, one less instructed and worse trained than the other. "Conversion" is presented to us as a physical process, bringing the better trained brain into action in such sort as to be the only or chief guide of the man's actions.

(To be continued.)

* I may in passing note that the case of Brown-Sequard's double-lived boy throws some light on the question whether the soldier is conscious in his abnormal state. Professor Huxley says justly that it is impossible to prove whether F. is conscious or not, because in his abnormal condition he does not possess the power of describing his condition. But the two conditions of the boy's life were not distinguished in this way, for he was perfectly rational, and could describe his sensations in both conditions. The only evidence we can have of any other person's consciousness was afforded by this boy during his abnormal state. But what strange thoughts are suggested by this twofold consciousness—or, rather (for twofold consciousness is intelligible enough), by this alternate unconsciousness? To the boy in one state, what was the other life? *Whose* was the life of which he was unconscious?

THERMAL-COLOURED RINGS.—M. Decharme, whose experiments on the flow of currents in pipes and their hydro-dynamic analogy to electric currents have attracted much attention, has also recently drawn attention to the fact that thermal-coloured rings bear a striking resemblance to electro-chemical-coloured rings. When a copper plate is exposed to the flame of a spirit lamp or a Bunsen burner, an irisated or rainbow-coloured corona is produced about the heated point. Under good conditions these colours are fixed and unalterable in the air. These rings are, according to M. Decharme, quite similar to Nobili's electro-chemical rings; like the latter, they succeed each other in waves, the colours being in the same order, namely, that of Newton's rings viewed by transmission. —*Engineering.*

THE WORKSHOP AT HOME.

By a Working Man.

IN treating of the dovetail joint on p. 233, I mentioned the "mitre and key:" I shall begin to-day by saying something about mitreing. Now, a mitre-joint in carpentry means one in which the faces in contact are at an angle of 45° with the length and width of the article in which they occur, as in Fig. 20, where T is the top and S the side of a

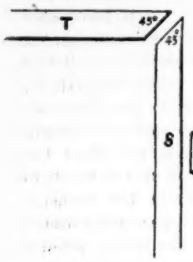

Fig. 20.

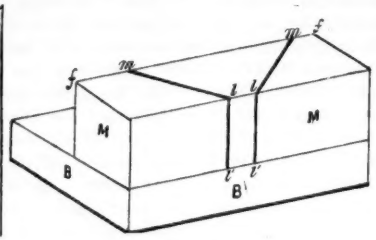

Fig. 21.

picture-frame, each bevelled off at the angle shown. If each bevel is perfectly accurate, it is easily seen that each of the four pieces of the frame will be truly square to the adjacent and parallel to the opposite one. We have, then, first got to cut them truly to this angle, and then to finish them with a plane without destroying it. They are usually cut in what is called a mitre-box, or mitre-block. Fig. 21 shows a mitre-block which the amateur can make for himself. In it B B is a sound piece of 1½ inch deal, with its upper surface planed up very true and flat. This may be a foot long and 7 inches wide. A block of beech-wood preferably (but deal will do) of the same length, but measuring 3½ inches in width and depth when finished, must also be very carefully planed up, with its sides accurately at right angles, the square (Fig. 7, p. 154) being repeatedly applied to test it as the work proceeds. This being worked up true is firmly attached to the face of the base board by glue and screws, as shown at M M, with which, as seen, it forms a step. It must here be particularly remarked that the depth from the top of the block, M M, to the bottom resting on B, though given above as 3½ in., must not quite equal the depth of the blade of our tenon-saw. Hence, if the latter measures less than this from the teeth to the metal rib at the back, the *height* of M M (not its width) must be reduced. It now remains to make two saw-cuts (or "kerfs," as workmen call them), as guides for our saw. The plan of the mitre-block shown in Fig. 22 will explain the way of doing this. First, by the

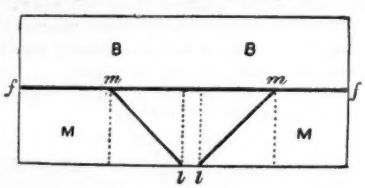

Fig. 22.

aid of our rule, square, and pencil, we draw the two squares shown in the figure, of which each side will obviously be 3½ in. long (that being the width of M M) upon it, and join the two corners of these squares, *l m*, *l m*, by straight lines, each of which will quite evidently be at an angle of 45° with the top of the block. We now place the square adjacent to the points *l l*, and draw the perpendiculars, *l l'*, *l l'*, on the back of the block. Finally taking a sharp saw, of which the blade is perfectly flat, we saw with the utmost care down *m l l'*, through the block, M M (the use of screwing as well as gluing now becomes manifest), and a little way—say ⅛ in. or ¼ in.—into B B. If now we want to cut a mitre, we simply hold the piece of wood tightly against the face, *f f*, of the block, pass the saw into either of the guide-lines, and saw right through it. By fitting a diagonal stop at the end of a piece of board, as shown in Fig. 23, and turning a

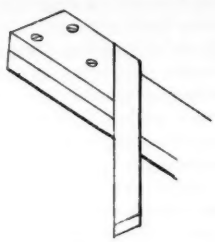

Fig. 23.

trying-plane on its side, with its bottom against the edge of the board, the sawn ends may be smoothed up quite true.

As an easy lesson in mitreing, the beginner may try to make a small picture-frame out of the cheap moulding to be bought in many parts of London. Having determined the dimensions of his frame, he must mark them off on the moulding, and saw them in the mitre-box, as explained above. *He must carefully study the direction of his mitres* though, noting that the inner edges of his frame must be the shorter ones, or he may find that he has sawn two parallel to each other on the same piece of wood! In the absence of the special cramps of the professional picture-frame maker, he may nail strips of wood on to a plank, three of them actually in contact with three of the sides of his frame, and the fourth a little way from the other, and *very* slightly inclined to it, driving a wedge-shaped piece of wood, planed to a corresponding slight slope, between this and the frame, after the latter has been glued up and put together on the plank. When the glue is dry, a saw-kerf may be made in each corner, and a bit of glued veneer driven in just as in our "mitre and key" work, on p. 233. It may be taken that, for the purpose of the ordinary amateur, the tenon and mortice, the dovetail and the mitre-joints are the only ones he is at all likely to have occasion for.

DICKENS'S STORY LEFT HALF TOLD.

A QUASI-SCIENTIFIC INQUIRY INTO

THE MYSTERY OF EDWIN DROOD.

By Thomas Foster.

(*Continued from p.* 342.)

THE scenes within the Billickin serve to show how little of his humorous power Dickens had lost—indeed, they are as good as anything in the same style he ever wrote: but they throw no light on the development of the story.

But the chapter significantly called The Dawn Again (the first is called The Dawn, but one is the dawn of the plot, the other the dawn of the discovery) is full of light.

It shows us, first, Crisparkle and Jasper face to face, Jasper as the denouncer and pursuer of Neville Landless and Mr. Crisparkle as his consistent advocate and protector.

Jasper is moody, solitary, and reticent. The frank Minor Canon cannot approach him. Mr. Crisparkle cannot guess whether Jasper supposes he has terrified Rosa into silence, or supposes, on the contrary, that she has imparted to any one the particulars of his interview with her. The following sentences seem to be intended to convey the precise truth about the views of Rosa, Crisparkle, Neville, and Helena, on the question of Jasper's guilt:—"The dreadful suspicion of Jasper which Rosa was so shocked to have received into her imagination, appeared to have no harbour in Mr. Crisparkle's; if it ever haunted Helena's thoughts or Neville's, neither gave it one spoken word of utterance." Compare this with what is said of Grewgious, noting that to have said more would have been to reveal all he meant to conceal:—"Mr. Grewgious took no pains to conceal his implacable dislike of Jasper, yet he never referred it, however distantly, to such a source; but he was a reticent as well as an eccentric man; and he made no mention of a certain evening when he warmed his hands at the Gatehouse fire, and looked steadily down upon a certain heap of torn and miry clothes upon the floor."

The scene at the opium-eater's den introduces the dawn of the day of reckoning for Jasper. He has been so long away that the old woman has forgotten him. He used to go there for comfort; "When I could not bear my life I came to get the relief and I got it," he says: "it WAS one! It WAS one!" He has come for relief again, and we may be sure he was to come at least once more. "The Princess Puffer has learned how to mix the drug so as to make him talk." "I heard ye say once when I was lying where you're lying," she says, "and you were making your speculations upon me, unintelligibly. But don't ye be too sure always: don't ye be too sure, beauty!" All this enables us to anticipate her share in bringing Jasper to justice, and enables us also to guess what Drood wants, to make Jasper's punishment complete. It must be remembered that though Edwin knows more than any one, except Mr. Grewgious, about Jasper's villany he does not know all. In particular he has still to learn whether Jasper attacked him in a sudden access of fury or whether the crime was premeditated. He knows Jasper was lying when he pretended love for "his dear Ned;" he knows Jasper loved and loves Rosa after the evil manner of his kind; but he does not know that Jasper had planned murder for months and had gone the journey which was so pleasant to the villain, "hundreds of thousands,—what do I say?—millions and billions of times." On the question of premeditation much will depend; but we may be sure that when Edwin learns with what intensity of premeditation Jasper had gloated over the crime, he will be ready to inflict on the villain the full horror of that punishment which lies within his power.

I pass over the light thrown upon the mystery itself by Jasper's words when under the influence of opium; for I have already considered his wanderings in this aspect, as the matters to which they relate arose. The chief importance of the scene lies in the light which it throws on the *dénouement*.

I am inclined to think that the place in Aldersgate-street where Jasper puts up, would have turned out in the sequel to be Bazzard's home. But there is no direct evidence on this point.

The opium woman's pursuit of Jasper brings her to Cloisterham, and to the very gateway where Jasper enters; but she only sees "a postern staircase on one side of it, and on the other side an ancient vaulted room, in which a large-headed, grey-haired gentleman is writing, under the strange circumstances of sitting open to the thoroughfare and eyeing all who pass, as if he were toll-taker of the gateway: though the way is free." Mr. Datchery's watch on Jasper is close, but it is no such watch as a professional detective would have kept. We note in passing that his "low voice" as he says "Halloa!" when he sees her, suggests that he has seen her before.

The burst of triumph in which she thanks him when she learns Jasper's name and office and that she can see and hear him in the Cathedral, does not escape the watchful Mr. Datchery, any more than it would have escaped his other self Edwin Drood. He thinks something may come of this and lounges after her, clasping "his hands behind him, as the wont of such buffers is," in other words, making himself as much like the sauntering listless young lad she had met near that self-same spot as a grey-haired man could look. It is clear that in some dim unconscious way she is reminded of the Eddy she had so earnestly warned half a year before. His hands are presently taken from behind him with a purpose. "His purposeless hands rattle the loose money in the pockets of his trousers." Whenever Dickens speaks of an action as purposeless, we may be sure he wishes to draw attention away from its purpose. Not suffering our attention to be thus withdrawn we see at once what Mr. Datchery wanted. "The chink of the money has an attraction for her greedy ears." She asks for money for her "travellers' lodging." "You know the place," he says (who had reason probably to know it well himself), "and are making directly for it," and, still rattling his loose money, he asks "if she has been often in Cloisterham." "Once in all my life." "Ay, Ay?" (These "ays" are as significant as those of Mr. Grewgious, in his conversation with Mr. Crisparkle in Chapter XVII.—they mean earnest attention, though intended to suggest the idea of an abstracted mind.) They have now reached the entrance to the monk's vineyard, and the place where the former interview had taken place. "An appropriate remembrance is revived in the woman's mind." (These are Dickens's own words.) She stops at the gate and says energetically, "By this token, though you mayn't believe it, that a young gentleman gave me three and sixpence as I was coughing my breath away on this very grass: I asked him for three and sixpence and he gave it me." "Wasn't it a little cool in you to name your sum?" hints Mr. Datchery, still rattling. "Isn't it customary to leave the amount open. Mightn't it have had the appearance, to the young gentleman—only the appearance—that he was rather dictated to?" If it is not Edwin Drood who talks thus quaintly, the passage was not written by Dickens. The old woman somehow feels that it is the same person, and asks for the same sum, telling him this time what she wants it for. He changes countenance when he learns that it is for opium, but he does not recognise the full significance of the fact. (This appears presently.) He counts the money very slowly, to give her opportunity to talk. I repeat the scene which follows, because it is so full of significance that it cannot be too often studied by those who wish to know the real plot of this interesting story:—

"It was Christmas Eve, just arter dark, the once that I was here afore, when the young gentleman gave me the Three and six."

Mr. Datchery stops in his counting, finds that he has counted wrong, shakes his money together, and begins again.

"And the young gentleman's name," she adds, "was Edwin."

Mr. Datchery drops some money, stoops to pick it up, and reddens with the exertion as he asks:

"How do you know the young gentleman's name?"

"I asked him for it, and he told it me. I only asked him the two questions, What was his Chris'en name, and whether he'd a sweetheart? And he answered, Edwin, and he hadn't."

Mr. Datchery pauses with the selected coins in his hand, rather as if he were falling into a brown study of their value, and couldn't bear to part with them. The woman looks at him distrustfully, and

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with her anger brewing for the event of his thinking better of the gift; but he bestows it on her as if he were abstracting his mind from the sacrifice, and with many servile thanks she goes her way.

John Jasper's lamp is kindled, and his lighthouse is shining when Mr. Datchery returns alone towards it. As mariners on a dangerous voyage, approaching an ironbound coast, may look along the beams of the warning light to the haven lying beyond it that may never be reached, so Mr. Datchery's wistful gaze is directed to this beacon and beyond.

I am unable to understand how any one can read this scene without feeling certain that Mr. Datchery is Edwin Drood, that he has purposely recalled the scene of which Drood alone knew anything, that he is moved when his own old name is mentioned, and still more when the thought of Rosa is brought before him. I feel for my own part as certain of this as though Dickens had said as much in so many words. What a detective would have had to do with such ideas as trouble Datchery, or how they can be associated with Bazzard's dull selfishness, or in fine with any one except Drood himself, passes my comprehension.

(To be continued.)

DREAMS:

THEIR PLACE IN THE GROWTH OF PRIMITIVE BELIEFS.

By Edward Clodd.

XI.

IT would exceed the limits and purport of these papers to follow the extension of the belief in spirits to its extreme range; in other words, to belief in controlling spirits in inanimate objects, which were advanced *pari passu* with man's advancing conceptions to place and rank as the higher gods of polytheism. Such belief, as already indicated, is the outcome of that primitive philosophy which invests the elements above and the earth beneath with departmental deities, until, through successive stages of dualism, the idea of a Supreme Deity is reached, and the approach is thus made towards a conception of the unity and unvarying order of nature.

The arbitrariness with which the gods are credited will have reference when the part played by dreams as media of communication between heaven and earth, and as warnings of coming events, is dealt with. Now, the intervals which have passed between the appearance of former chapters make it desirable to focus the conclusions which thus far have been reached, and to ask whether the evidence gathered together has justified them.

It has been shown that races have existed, and exist still, at so low a level that their scanty stock of words has to be supplemented by gestures, rendering converse in the dark next to impossible. Such people are bewildered by any effort to count beyond their fingers; they have no idea of the relation of things, or of their differences; they have no power of generalisation by which to merge the accidental in the essential. They believe that their names and likenesses are integral parts of themselves, and that they can be bewitched or harmed through them at the hands of any one who knows the one or has obtained the other. As an important result of their confusion between the objective and the subjective, we find a vivid and remarkable belief in the reality of their dreams. The events which make up these are explained only on the theory that if the body did not move from its sleeping place, something related to it did, and that the people, both living and dead, who appeared in dream and vision did in very presence come. The puzzle is solved by the theory of a second self which can leave the body and return to it. For the savage knows nothing of *mind*. The belief in this other self is strengthened (possibly, more or less created) by its appearance in shadow or reflection, in mocking echo, in various diseases, especially fits, when the sufferer is torn by an indwelling foe, and writhes as if in his merciless grasp. The belief in such a ghost-soul, as to the form and ethereal nature of which all kinds of theories are started, is extended to animals and lifeless things, since like evidence of its existence is supplied by them. The fire that destroys his hut, the wind that blows it down, the lightning that darts from the clouds and strikes his fellow-man dead beside him, the rain-storm that floods his fields, the swollen river that sweeps away his store of food—these and every other force manifest in nature add their weight to the influences rude man has drawn. The phenomena which have accounted for the vigour of life and the prostration of disease account for the motion of things in heaven above and the earth beneath, and the barbaric mind thus enlarges its belief in a twofold existence in man to a far-reaching doctrine of spirits everywhere. Step by step, from ghost-soul flitting round the wigwam to the great spirits indwelling in the powers of nature, the belief in supernatural beings with physical qualities arises, until the moral element comes in, and they appear as good and evil gods contending for the mastery of the universe. Passing by details as to the whereabouts of the other self and its doings and destiny in the other world which the dream involves, and following the order of ideas on scientific lines, two queries arise:—

1. Does the evidence before us suffice to warrant the conclusions drawn from it as to the serious and permanent part which dreams have played in the origin and growth of primitive belief in spirits; in short, of belief in supernatural agencies from past to present times? In this place, the answer is brief.

If dreams, apparitions, shadows, and the like, are sufficing causes, then, in obedience to the Law of Parsimony (as it is termed in logic), we need not invoke the play of higher causes when lower causes are found competent to account for the effects. If it seems to some that the base is too narrow, the foundation too weak for the superstructure, and that our metaphysics and our beliefs regarding the invisible rest upon something wider and stronger than the illusions of a remote savage ancestry, the facts of man's history may be adduced as witness to his continuous passage into truth through illusions; to the vast revolutions and readjustments made in his correction of the first impressions of the senses. There is not a belief of the past, from the notions of savages about their dreams and ghost-world to those of more advanced races about their spirit-realms and its occupants, to which this does not apply. In the more delicate observations of the astronomer he must, when estimating the position of any celestial body, take into account its displacement through the refractive properties of the atmosphere, and must also allow for defects of perception in himself due to what is called "personal equation." And in ascertaining our place in the scale of being, as well as in seeking for the grounds of belief concerning our own nature, we have to take into account the refracting media of dense ignorance and prejudice through which these beliefs have come, and to allow for the confirming errors due to personal equation—fond desire.

2. Does the theory of evolution in its application to the development of the spiritual nature of man, and to the origin and growth of ideas, find any breach of continuity? In its inclusion of him as a part of nature, in accounting for his derivation from pre-human ancestry by a process of

natural selection, and of his unbroken development from the embryo to adult life, it embraces the growth and development of mind and all that it connotes. In the words of Professor Huxley, "As there is an anatomy of the body, so there is an anatomy of the mind; the psychologist dissects mental phenomena into elementary states of consciousness, as the anatomist resolves limbs into tissues, and tissues into cells. The one traces the development of complex organs from simple rudiments; the other follows the building up of complex conceptions out of simpler constituents of thought. As the physiologist inquires into the way in which the so-called 'functions' of the body are performed, so the psychologist studies the so-called 'faculties' of the mind. Even a cursory attention to the ways and works of the lower animals suggests a comparative anatomy and physiology of the mind; and the doctrine of evolution presses for application as much in the one field as in the other."*

Any coherent explanation of the operations of nature was impossible while man had no conception or knowledge of the interplay of its several parts. Now, by the doctrine of continuity, not only are present changes referred to unvarying causes, but the past is interpreted by the processes going on under our eyes. We can as easily calculate eclipses backwards as forward; we can learn in present formations of the earth's crust the history of the deposition of the most ancient strata; we read in a rounded granite pebble the story of epochs, the fire that fused its organic or inorganic particles, the water that rubbed and rolled it; we reconstruct from a few bones the ancestry of obscure forms, and find in the fragments the missing links that connect species now so varied. And the like method is applied to man in his *tout ensemble*. His development is not arbitrary; what he is is the expansion of germs of what he was.

Till these latter days he has, on the warrant of legends now of worth only as witnesses to his crude ideas, presumed on an isolated place in creation, and excepted his race from an inquiry made concerning every creature beneath him. The pride of birth has hindered his admission of lineal connection between the beliefs of cultured races and the beliefs of savages, and pseudo-scientific writers still confuse issues by assuming distinctions between races to whom spiritual truths have been revealed and races from whom these truths have been withheld. But the only tenable distinction to be drawn nowadays is between the scientific and pre-scientific age in the history of any given race.

TRICYCLE EXHIBITIONS.

By John Browning,

Chairman of the London Tricycle Club.

WITHIN the last few days a statement has been published that a meeting of tricycle manufacturers has been held, and that it was decided by a majority of *one* not to support either of the tricycle exhibitions next year. Seventeen firms voted against supporting an exhibition, and sixteen in favour of doing so. An agreement was drawn up and has been signed by the seventeen firms pledging themselves not to exhibit at any show of tricycles in London in the spring of next year.

I have taken the trouble to ascertain the opinions of many well-known tricyclists on this subject, and I have found that, without exception, they view it with regret and disappointment, and I might, without exaggeration, say with consternation.

I am at a loss to understand why the manufacturers have come to such a decision, unless it be that they are dissatisfied with the arrangements which have been made for them by those who have organised and conducted previous exhibitions.

If this be the case, it is a pity they did not appoint a committee of their number to arrange for an exhibition to be carried out on their own lines.

Of course, there are strong temptations to avoid the loss of time and trouble, and the expense of sending machines to such an exhibition, if they can arrange with their competitors in trade to stay away. But they cannot arrange that tricycle dealers and agents and makers of inferior machines shall also stay away. The result will almost certainly be that we shall have one or more poor exhibitions, instead of good ones.

Agents will be more likely to exhibit second-class machines than first-class, because there is generally a much larger profit to be made in dealing in them; and in consequence, the first-rate manufacturers and the cycling public will both be sufferers, which cannot surely be what they desire.

In any case, it is obvious that the manufacturers who do not exhibit will lose a number of orders. Many people who already have tricycles are looking forward to the exhibition for the opportunity of obtaining what they anticipate will be better ones; and unless they see all the new machines and are able to compare them, they will content themselves with their old mounts, and that amount of business will be sacrificed.

I know personally dozens of riders, mostly of considerable means, who come to London from great distances for the purpose of attending the tricycle exhibitions. A goodly number of these make purchases either at the time or not long after. The opportunity and the temptation being removed, they will keep their money in their pockets.

Two-speed gearings and Tandems will, no doubt, be largely in demand next season, but this demand would be greatly increased if they were well exhibited.

For these reasons, it is to be hoped that the leading manufacturers may yet reconsider their decision, and not pursue a course which will check the progress of cycling and the improvement of cycles, disappoint their patrons, and play into the hands of their less worthy competitors.

THE EARTH'S SHAPE AND MOTIONS.

By Richard A. Proctor.

CHAPTER V.—THE EARTH'S ROTATION.

(*Continued from page* 316.)

IN 1820, Dr. Benzenberg began a series of experiments in St. Michael's Tower in Hamburg. The height he was able to command was 340 ft. But he preferred to limit the fall to the portion of the tower which was completely closed, and thus he commanded a range of fall of about 235 ft. only. The balls he used were $1\frac{1}{2}$ in. in diameter, made of an alloy of equal parts of lead and tin, and a small proportion of zinc. They were carefully turned and polished, so that there might be no irregularity of figure to occasion any departure from the line of fall. He tested them specially for this purpose, by floating them in mercury, and rejected all those which showed any tendency to float in one position rather than in another. So carefully did he consider all the possible sources of error in the result that he would not even allow the liberation of the balls to be effected by

* Hume, p. 50.

burning the thread, as Guglielmini had done, lest slight draughts of air thus occasioned might cause the ball to oscillate before being detached. The mode of liberation he actually employed was ingeniously devised to prevent the balls from being in any way influenced by the act of liberation. The suspending thread passed through a vertical aperture in a block, and was clapsed above by nippers, opening in an horizontal plane.

He dropped, first, a number of balls experimentally, to gauge the requirements of the problem. At last, when all the arrangements had been made which these experiments suggested, he dropped 31 balls. Of these

21 fell towards the east.
8 ditto west.
2 neither towards the east nor west.
16 fell towards the south.
11 ditto north.
4 fell neither towards the south nor north.

The actual deviations carefully summed gave the following results:—

Sum of deviations towards the		north	46·4 lines,
Ditto	ditto	south	92·6 ditto
Ditto	ditto	east	174·5 ditto
Ditto	ditto	west	50·5 ditto
Balance of deviations towards the		south	46·2 ditto
Ditto	ditto	east	124·0 ditto

As there should be no deviation towards the south, we must take the observed deviation in that direction as measuring the probable errors in the series of experiments. This leaves to be accounted for an obvious tendency towards the east—that is, in the direction according with the theory of the earth's rotation. The mean deviation towards the east is $\frac{124}{31}$, or four lines. Calculation shows that the mean deviation should have been 3·85 lines, so that theory and observation agreed very closely.

But Benzenberg thought the southerly deviation too considerable to render his experiments satisfactory. He therefore made new experiments in an abandoned coal-pit at Schlebusch, in Westphalia, with an available fall of 262 ft. He carefully covered the entrance of the pit, and blocked up all its lower passages before commencing his experiments. He then dropped twenty-nine balls. The results were as follows:—

Sum of deviations towards the		north,	124 lines
Ditto	ditto	south,	103 ditto
Ditto	ditto	east,	189 ditto
Ditto	ditto	west,	42 ditto

or a mean northern deviation of 0·7 lines and a mean easterly deviation of 5·1 lines. The calculated easterly deviation for a fall of 262 ft. is 4·6 lines; so that in this experiment, as in the preceding, theory and observation agreed very closely together. As in these experiments, also, a balance of deviation towards the north was observed, while in the former the balance of deviation was towards the south, we see the more reason to regard northerly and southerly deviations as the result of those errors which can never be altogether avoided in experiments of the sort.

Lastly, a long and most convincing series of experiments was carried out on the same plan by Professor Reich in the mines of Freiburg. He was able to drop balls to a depth of no less than 488 ft., and he made no less than 106 experiments. There was a balance of southerly deviation of 48·76 lines, and a balance of easterly deviation of 1093·92 lines; so that the mean deviation towards the south was but 0·46 lines, while the mean deviation towards the east was 10·32 lines.

Here, then, we have in all a series of 166 experiments, with a result pointing very definitely to an easterly deviation in bodies falling from a great height. We are compelled to conclude that this cannot be accidental. It must arise from some real cause or other. The earth's rotation accounts most satisfactorily for it, whereas no other explanation seems to suggest itself as even possibly explaining the phenomenon. Thus we are again led to the conclusion that the earth rotates upon its axis from west to east.*

The evidence of the earth's rotation, derived from the oscillations of a free pendulum, is also singularly powerful and interesting. But this has been already fully considered in a former number (*see* KNOWLEDGE, June 6, 1884, p. 413.)

MATCH-LORE.

IN Shelley's wonderful version of the Homeric Hymn to Mercury, we learn that

> Mercury first found out for human weal,
> Tinder-box, matches, fire-irons, flint and steel.

We can give no further particulars of these early inventions, but our readers may be interested in tracing the lines of modern improvement. Old folks can remember when "Any matches to-day; buy my matches," were common London cries, and the articles offered for sale were strips of deal about six inches long and more than half an inch wide. They were pointed at each end, and dipped in melted brimstone. A piece of greasy rag well charred by partial burning, constituted the tinder, usually kept in a circular tin box with a cover that held a candle, and accompanied with pieces of black flint, and a steel implement like a miniature hoe with a horizontal handle like a flat-iron. This was held in the left hand, the flint struck smartly against its edge, and a shower of sparks sent down upon the tinder. The performer blew gently upon the first portion that ignited, put the match to it, and set the brimstone alight. A round tin damper was then pressed upon the timber to put it out, and the operation was finished. It was an easy one for most folks to learn, but some clumsy hands boggled over it, and could elicit neither spark nor flame. To this day some smokers use a flint, and Amadou tinder, made of a fungus, *Polyporus fomentarius*, beaten out and steeped in a solution of saltpetre; but few of these, or of the old operators in our grandmother's kitchens ever knew that they were producing objects well worth seeing under the microscope.

* For a complete account of the theory of the method here considered, the mathematical reader should refer to Worms' admirable treatise on "The Earth and its Mechanism," to which I have been indebted for most of the above facts. It is worthy of notice that in all the 166 experiments considered above, there was not a single instance in which a ball fell either exactly below the point of support, or exactly where it should have fallen, according to theory. We can very well understand this, of course, when we remember the multitude of circumstances (individually minute, yet collectively appreciable) which affect the progress of a falling body, let our precautions to ensure accuracy be what they may. It will be admitted that the balls let fall in these experiments had a much better chance of falling undisturbed than a ball fired in the open air from a gun of any sort, fixed in a vertical position, could have of rising straight to its highest point, and then falling straight down again. Yet the paradoxist "Parallax" gravely assures his pupils that he once fired forty balls from an air-gun tied in a vertical position, and that two of these fell back into the muzzle of the gun. I would not be so rude as to say with Dante, "Io non vidi, ne credo che sia;" rather would I imitate the politeness of the Frenchman, who, on a similar narrative being related to him, said: "Aha! my good sir, thanks; you have seen this, therefore I believe it. I would not have believed it had I seen it myself." For all I know to the contrary, the similar narrative was "Parallax's" famous canal experiment.

If a shower of sparks, struck with flint and steel, is caught on a sheet of paper, and the particles viewed as opaque objects in a strong light, a number of bright metallic balls will be seen. They are portions of steel melted by the heat of the concussion, and they cause the timber to ignite.

The first attempts to obtain a substitute for the tinder-box by chemical means was made with matches like the common lucifer, first dipped in brimstone, and then in a mixture of chlorate of potash and lump-sugar. Chemists used to sell them in square tin receptacles, usually ornamented by washing the metal over with dilute nitric acid to make it crystallise in fern-like patterns, and then covering with a transparent varnish of gold or ruby tint. In front of the match-holding part was a smaller compartment to hold a little bottle, at the bottom of which was some fibrous asbestos moistened with sulphuric acid. The match was lit by bringing it in contact with the acid.

The next plan was to make Prometheans, as they were called, by rolling up in the end of a paper spill a tiny glass vesicle containing sulphuric acid, and surrounding it with a little lump sugar and chlorate of potash. A slight blow broke the vesicle and ignited the preparation. These things were neither cheap enough nor handy enough to become popular, and they soon disappeared to give place to deal matches, coated at their tips with brimstone overlaid with chlorate of potash and sulphuret of antimony. These could be ignited by drawing them briskly through a folded card to which sharp sand was glued. Phosphorous matches succeeded these, and for many years the sort in general use was made at the cost of terrible injury to the workmen making them, as continuous exposure to phosphorous fumes causes disease of the jaw-bones and other evils.

Phosphorous is one of those curious substances which can exist in what are called allotropic states; that is to say, their molecules are capable of arrangement in different patterns, with variations of their properties. Common yellowish-white semi-transparent phosphorous is highly poisonous, as well as extremely inflammable. It can be crystallised from its solutions. By keeping it melted in an atmosphere of carbonic acid for many hours, it is turned into red amorphous phosphorus, which is much less inflammable; does not flame at ordinary temperatures; and does not poison the workmen. There are other modes of producing this condition; and in one of its states phosphorus is black. All the best makers now use the innocent varieties of phosphorus for their matches, and the safety kinds have the phosphorus on the black cards stuck on the boxes, or supplied with them. Neither the match nor the phosphorus in this state can be ignited by accident, but when they meet with the excitement of friction, a quick blaze is obtained.

Although not belonging to match-lore, two interesting substitutes for matches may be noticed in connection with them. In 1824 Professor Döbereiner discovered that platina, in a finely-divided state, ignited a mixture of hydrogen with oxygen, or common air, on coming in contact with it. This gave rise to Döbereiner's lamp, still seen in some chemists' windows. It consists, as now made, of a small glass vessel inside a larger one. Hanging down towards the bottom of the inside vessel is a piece of zinc. Dilute sulphuric acid is put into the outer vessel, and rises up in the inner one. The chemical action which ensues evolves hydrogen, which fills the inner vessel, expelling the dilute acid. On turning a stop-cock connected with the hydrogen reservoir, the gas escapes and strikes against a little ball of platina-sponge, which ignites it. As soon as any gas goes out of the reservoir a fresh supply of dilute acid enters, and again acts upon the zinc until enough gas is given off to drive out the fluid and stop the process. This apparatus is so pretty and neat that it would, no doubt, have been in much favour, but for the difficulty that its action is very uncertain unless the platina-sponge is new and is perfectly clean.

Volta appears to have invented a lamp that bore his name, and consisted in an apparatus for the production and storage of a small quantity of hydrogen, which was lit on its issue in a fine jet by an electric spark obtained from an electrophorus. We recollect seeing one of these lamps many years ago. It was in the form of a handsome mahogany box, about fourteen inches high, with a little brass dragon mouth for the flame to come out of. At the bottom of the box was a drawer containing an electrophorus, to be excited by striking it with a fox-tail. The hydrogen part of the apparatus was analogous to that of the Döbereiner lamp. On turning a key the gas was allowed to escape, and, at the same time, the electrophorus yielded its spark. In a very dry country such a machine would work well, but in our damp one the electrophorus did not keep its power. S.

RAMBLES WITH A HAMMER.

THE GEOLOGY OF CRICCIETH AND PWLLHELI.

By W. Jerome Harrison, F.G.S.

IT is, I regret to say, fully two years since the appearance in Knowledge of my papers on the geology of Llandudno and Rhyl. Still, the delay has not been without its advantages, for it has enabled me to examine more carefully the region which I am now about to describe—Criccieth having been my headquarters for a few weeks during the summer of 1883, and Pwllheli for a similar period during the present year.

How to Get There.—The two picturesque Welsh towns whose names stand at the head of this article lie snugly within the northern curve of Cardigan Bay. They are well sheltered by hill ranges—mountains they may be fairly called—on the east, west, and north, but the coast slopes southwards to the sea, while the waves which lave the shore can trace their parentage to the Gulf Stream.

Criccieth is rapidly becoming fashionable. Artists found it out long ago, and this year it has been crowded with visitors. But Pwllheli, the terminus of the Cambrian Railway, is a typical Welsh town. It is rather hard on its worthy inhabitants to wish that it may remain comparatively unknown and unvisited, yet there is a strong temptation for those who know it well to—keep their knowledge to themselves. Travellers from the North or from the Midlands will reach either town most expeditiously by travelling through Chester to Bangor. From Bangor a branch of the London and North-Western runs due south to Afonwen, a little junction where there are no houses. Criccieth lies about four miles east of Afonwen, and Pwllheli the same distance to the west, each forming stations on the railway—the Cambrian—which encircles Cardigan Bay. Another route is to travel by the Great Western from Ruabon to Barmouth (through most lovely scenery), and then northwards from Barmouth by the Cambrian line. But, whatever route the traveller adopts, his ride will be a long one if he proceeds direct from any of our great towns. Yet is the long journey not without its compensation, for the "cheap tripper" is left behind, and the negro minstrel troubleth not.

The Geologist's Equipment.—Let the man who means to examine Welsh rocks provide himself with a stout pair of thick-soled, wide-across-the-toes, lace-up boots; a good "shooting boot," with a *few* nails, answers well. Flannel, next the skin of course, with a stout, dark, tweed suit,

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soft hat, large mackintosh, and a good large bag to carry his specimens. I use a gamekeeper's bag, although it sometimes attracts undesirable attentions. Two hammers are desirable—a heavy one, weighing about 3 lb., and provided with a long ash handle to cope with the massive, tough, and often rounded rocks, and a light ½ lb. trimming hammer, to reduce specimens to shape in the field; geological hammers are square in the face, and should be made of good steel. A cold chisel (as the solid iron chipping tool is called) is useful for detaching fossils from the rocks, while a magnifying glass (Browning's platyscopic lens is the best) is very necessary to examine minerals, &c. Of other requisites, the coloured map of the district, executed by the Geological Survey is most useful; Sheet 75 (in four parts or "Quarter Sheets," price 3s. each) includes the district in which we are more directly interested. A pocket-compass is very useful in this rather lonely region, where it is quite the exception to find a labourer or field-hand who can speak English; the compass may form part of a clinometer, an instrument with which we can measure the dip or slant of any set of rocks. A tape-measure is handy, when it is desired to measure the thickness of the strata, or the depth of the rock-sections exhibited in cliffs, cuttings, &c. A note-book and pencil ought certainly to be carried, in order to note down, on the spot, the particulars relative to each quarry or other exposure. All these articles may be procured from Mr. Gregory, of Charlotte-street, Fitzroy-square.

How to Collect Rocks.—Every specimen collected ought to be capable of identification, as to the exact locality from which it came, at any future time. Such particulars may be noted in pencil upon the paper in which the rock, fossil, or mineral is wrapped, or upon a slip of paper placed with the specimen; but a better plan is to carry a series of gummed and perforated numbers, and to attach one of these to each specimen as it is secured, copying the number in the note-book, and adding the locality, date, &c. Each specimen should be wrapped up separately (best in thin, tough brown paper) so that it may not grate against and scratch its fellows. Remember that small angular bits of rock are of little use; try to obtain neat, oblong specimens—3 inches long by 2 broad, and 1 inch thick is a useful size—and let them be of fresh unweathered stuff taken from the middle of a block, and as far below the surface as possible.

There is only one book which treats specially of the rocks of Carnarvonshire—Ramsay's "Geology of North Wales," Stanford, 21s.; but it is a splendid work of 600 pages and many illustrations. The author, Sir A. C. Ramsay, late head of the Geological Survey, knows the ground well, having either mapped, or aided in mapping, a large portion of the district: and although we may not always agree with his theories, yet his facts are numerous and reliable.

Rocks of the Lleyn Peninsula.—The projecting mass which forms the northern horn of Cardigan Bay and the western half of Carnarvonshire, is known as the Lleyn Peninsula. Viewed broadly it consists of certain extremely hard rocks, usually called *igneous*, because they are supposed to have been at one time liquefied by the action of heat, surrounded by softer sedimentary strata which mantle round the unstratified igneous bases, forming an undulating plain. The geological age of all these rocks is indicated in the following table, the oldest or first-formed being placed at the bottom.

Bala Beds, 1,000 feet? Arenig Slates, 300 feet?	Lower Silurian Formation.
Tremadoc Slates, 0 to 200 feet Lingula Flags, 1,200 to 2,000 feet	Cambrian Formation.
Schistose Rocks, Porphyritic Felstones, &c., thickness unknown	Pre-Cambrian Formation.

Pre-Cambrian Rocks.—A fierce conflict has long raged, and is still raging, as to whether there are any rocks in Wales of older date than the Cambrian strata. Strange to say, the dispute has resolved itself into one between "official" and "non-official" geologists. The new chief of the Geological Survey—Professor A. Geikie—upholds the views of his predecessor (Sir A. C. Ramsay), and is supported by his colleagues in arguing *against* the existence of such rocks; while Dr. Hicks, with Professors Hughes, Bonney, Lapworth, Blake, Callaway, and others, ardently assert that at various points—as around St. David's, in South Wales, and at several spots in North Wales, and Anglesea—very ancient strata do exist, comparable in age with the Archæan Gneiss of the Hebrides, and the Laurentian Rocks of Canada, the very bottom beds of the earth's crust.

But, it may be asked, if the officers of the Geological Survey deny the existence of pre-Cambrian rocks in Wales, what age do they assign to the rock-masses whose claim to that high antiquity was first upheld by Dr. Hicks? To this the reply would doubtless be, that each case, each locality where such rocks are said to occur, must be dealt with separately, for the explanation that might be applicable to one example would very probably not answer elsewhere. Still, the Survey views of the so-called pre-Cambrian rocks may be summed up under two heads:—(*a*) They are *altered* Cambrian strata, Cambrian rocks which have been so baked and pressed, and altered by chemical action at some former time when they were deep down, far below the surface, that their appearance has been quite changed, and any fossils which they may once have contained have been destroyed; or (*b*) they are intrusive, igneous rocks which have invaded, while in a liquid state, the strata lying above them. The first explanation would be used when the "pre-Cambrians" are of a schistose or slaty nature; the latter, when they are felsitic or granitic in appearance. Let us examine such of the rocks that lie within an easy drive of Pwllheli or of Criccieth, as would probably be classed by the "new school" with their pre-Cambrian beds.

The little town of Nevin lies seven miles north-west of Pwllheli, with which it is proposed to connect it by a railway, although it is difficult to see where the traffic to pay dividends on such a line is to come from. The mail-car affords a ready means of transit between the two towns, leaving Pwllheli at eight in the morning and returning from Nevin between four and five in the afternoon; or a trap may be hired from the Madryn Arms at a very reasonable rate. Reaching Nevin the geologist finds himself on the shore of Carnarvon Bay, and overlooking the splendid natural harbour of Porth-Dinlleyn. From the western side of this bay a rugged promontory juts into the sea. The rocks of this headland are marked as "serpentine" on the Survey Map; but Prof. Bonney has lately shown them to be compact diabases, very probably ancient lavas. In such a case as this we must remember that the Survey Map was executed thirty or forty years ago, when the modern method of investigation of rock structure by means of the microscope was unknown. In the case of this Porth-dinlleyn rock it is chiefly by the study of slices cut to the one-thousandth of an inch in thickness that we are able to ascertain its real nature.

The beds traversed by these lavas are volcanic breccias, consisting of dust ejected from some vents then in activity, but also containing innumerable angular blocks of all sizes, all non-compacted with a greenish, patchy-looking rock. South of Porth-Dinlleyn, green and grey compact schistose rocks, traversed by numerous veins of white quartz, extend

for twelve miles from Edeyrn to Braich-y-pwll. The beds incline to the westward, dipping at angles of from thirty to fifty degrees. This strip of pre-Cambrian rocks is from two to four miles broad. On the west and south is the sea, while its eastern boundary is marked by a dislocation, or line of fault, so that the true relations of the strata to the succeeding Cambrian beds cannot be traced. On the Survey Map the entire strip is coloured as "altered Cambrian," but it is difficult to conceive of any agency which could so completely alter so great a thickness of strata, in addition to which there is clear evidence that these most ancient rocks are largely volcanic in their nature and origin, while the Cambrian rocks of Wales exhibit no traces of such action.

Bardsey Island consists of similar hard schists to those of the mainland, all much contorted. It is best reached by boat from Aberdaron.

(To be continued.)

THE INTERNATIONAL HEALTH EXHIBITION.

XXII.—THE PRESENT ASPECT OF THE SEWAGE QUESTION.

THAT the old adage, "prevention is better than cure," seems at last to have gained ground as a principle of the first importance amongst modern sanitary engineers, is amply testified to by the many valuable measures which have of late been brought into operation, and prominently placed before the notice of the public at the Exhibition which has just come to a close.

"The Rivers Pollution Prevention Act, 1876," enacts "that any person who causes, or knowingly permits, any noxious or polluting liquid proceeding from any factory or manufacturing process to fall, flow, or be carried into any stream shall be deemed to have committed an offence against that Act." As an outcome of this measure, a company, entitled the "Manufacturers' and Mill-owners' Mutual Aid Association," has been instituted, under the presidency of the Hon. C. W. Wentworth Fitzwilliam, M.P., of Alwalton, Peterborough. It has been expressly established to provide means whereby manufacturers, mill-owners, and others may be enabled to carry into effect the provisions of the Acts in force for the prevention of pollution of rivers; and we would here call the attention of sanitary authorities, riparian owners, occupiers of factories, mills, mines, and other analogous industries to the advantages held out by the Association.

Taking it for granted that the majority of the manufacturers are at a loss how to proceed in the elimination of noxious liquid matters proceeding from their works, and how to counteract the evils by a judicious outlay, the company have established a skilled staff, supplemented by an adequate capital, to supply their wants. A sample of the effluent water may be sent to them for reporting upon at an agreed rate, and the result of investigations will include an estimate of the cost for the entire prevention or mitigation of the nuisance; at the same time an explanation is given of the advantages likely to accrue through the working of the process in each special instance. The Association, moreover, either performs the required work, or advances money for its fulfilment.

We may add that the process which has been applied by them for many years, with the highest degree of success, is one of ordinary straining, conducted in such a way as to retain and separate all fluids of an oily nature, in addition to solid particles. The straining is carried on through a succession of frames, with suitable filtering cloths stretched upon them, and has been in operation at Messrs. S. H. Johnson & Co.'s exhibit for the Association in the grounds of the Exhibition. Numerous models and actual machines for the purification of rivers and streams, with samples of water before and after treatment, and many valuable products gained therefrom, testify to the worth of the processes employed. We may also remark that the filter-case of the excellent Carbon Paper Water-Filter of Messrs. Johnson, of Stratford, E., has been constructed upon the principle of their larger straining apparatus, now adopted by the Association.

We thus see how easily a compliance with the Act of Parliament for the prevention of Rivers Pollution may be established; and we trust that all those interested in the question may be led to inquire more particularly into the details of the benefits to be derived from the Association by an application to its secretary at 5, The Sanctuary, Westminster, S.W.

Sewage contamination, such as that which flows into the Thames and other rivers of importance, has for some time past been a sore subject of discussion. Many are the plans that have been suggested from time to time to effect a complete cure. Amongst these, the extension of main sewers to carry away the offensive products far out into the sea, the distribution of the sewage over the land, &c., have failed to attract any attention, because they are calculated to overcome the evils by a substitution of enormous expenditure without any adequate return.

We believe that the question admits of solution in a mitigation or abatement, rather than in a wholesale prevention. In the instance of diseased conditions, the enlightened physician does not seek to make a radical cure of the case he has diagnosed, but rather to adopt a process of gradual reduction. Here we have a kind of sewage disease which has been going on year after year for a considerable period of time, and we hold that the treatment, to be effectual, must involve a process of time, so as to keep up an equilibrium in the administration of benefits for the public; in short, Peter must not be robbed to pay Paul.

Dwelling-houses are being erected in every direction around London with marvellous rapidity. Why cannot the Local Boards of each district compel each new builder to dispense with sewers for excrementitious matters, and make use of the earth-closet and ash systems of the Manchester Corporation, Morrell, and others? The waste products would certainly entail an increment in the staff of their dustmen; but then it can be clearly shown that they may be turned to profitable account, and thus add to the available funds of each district for the benefit of its poor and helpless. In course of time the suburbs would become healthy without aggravating the evils of the metropolis, and there would then only remain the sewers of the latter to contend against. Then, too, extensions of the systems could in time be put into operation, so as to lessen the sewage, by a disuse of the water-system in existing houses and the introduction of the earth and ash processes. Gradually the reform would work inwards, until the great centre of the city itself is subjugated.

In the meantime, however, other methods of value are available, and if they are also brought into use, we cannot really see why the Thames water should not be rendered permanently wholesome. Amongst these, we may mention that of the Native Guano Company (Limited), of 29, New Bridge-street, Blackfriars, E.C., called the "A.B.C. process for the prevention of pollution of rivers by the purification and utilisation of sewage," exhibited under group 3, class 22, at the Exhibition. The Company deservedly obtained a Gold Medal and Diploma of Honour at last year's

"Fisheries Exhibition." We had occasion at the time of that display to accord them a favourable notice in these pages; but for the benefit of our readers we may briefly allude once more to their system:—

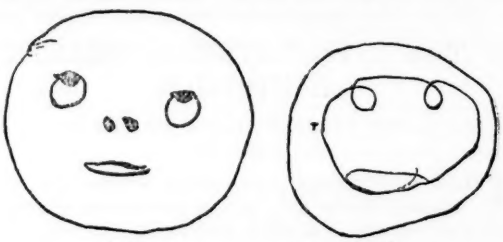
It consists of the addition of their patented "A.B.C." mixture to the sewage, with the result that all the offensive products are precipitated and subside. The water then is permitted to flow off, freed from smell and perfectly innocuous. The precipitated products are next collected, dried, and sold under the name of native guano. Of the value of this last-named product, we can only speak from what we have seen at the Exhibition, where a goodly supply of vegetables, &c., grown on a soil manured with the native guano, daily decorated the flanks of their stalls. We have no doubt that the company would be glad to forward their large pamphletful of testimonials to any anxious inquirer. So we find that there is a process of considerable value open to the Board of Works in dealing with the sewage question—a process which would not involve any but initial expenses, and which, we are assured, would ultimately be both valuable to the community at large, and become eventually eminently lucrative.

We hope in future to continue these articles in the form of papers which shall deal with this and other unnoticed departments of the Exhibition in detail, and which may be of interest or value to our subscribers.

THE SOCIETY FOR PSYCHICAL RESEARCH.*

THE four reports of the Society for Psychical Research which have been issued at intervals during 1882 and 1883 have now appeared in the form of a handsome volume, and it cannot be denied that they constitute a formidable body of evidence in favour of certain beliefs which have hitherto been looked upon with peculiar suspicion and distrust. A brief *résumé* of the testimony does not do it justice, for it derives its weight from the cumulative effect of its large amount. No one who is interested in bringing fresh regions of ignorance under the domain of scientific investigation should fail to read the proceedings for himself.

The society was organised on Feb. 20, 1882, but several of its members had been engaged in private research in the same direction for some years before. Its object was stated to be the investigation of an important body of remarkable phenomena, resting upon the testimony of many competent witnesses, including observations recently made by scientific men of eminence in various countries, and *primâ facie* inexplicable on any generally recognised hypothesis. The distinction of its founders is such as to completely dissociate it from the race of the long-haired, and to insure at once respectful consideration for whatever facts it vouches for. They include such names as Balfour Stewart, Arthur Balfour, Professor Barrett, Edmund Gurney, F. W. H. Myers, Archbishop French, and Professor Henry Sidgwick (the president). The members are not committed to any theory, and are not advocates of any cause. It is their intention to remove, if possible, what they justly say is a great scandal, the existing state of absolute doubt as to whether phenomena testified to by a large number of generally credible witnesses, and of great scientific importance if true, can be properly authenticated or not. Their experiments are conducted with the most rigid precautious against deception and mistake, and, what is equally important, recorded with scientific precision. Six committees were formed for the consideration respectively of thought-reading, mesmerism, Reichenbach's experiments in regard to a peculiar sensitiveness to electric currents, apparitions and haunted houses, physical phenomena, and the collection and collation of existing materials bearing on the history of these subjects. Of their several reports, those of the committee on thought-reading, or thought-transference, as they call it later, are the most striking. The significance of the term "thought-transference" is limited to the communication of a vivid impression or a distinct idea from one mind to another, without the intervening help of the recognised organs of sensation. No account is taken, very naturally, of experiments in which there is physical contact between the persons concerned, or in which there is the slightest possibility of conveying information by sight or hearing. The extreme perfection to which a code of signals may be brought leads the committee to distrust all observations where two particular persons are necessary for the results



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obtained. Their most remarkable subjects for thought-transference have been found in a family in Derbyshire, that of Mr. Creery, a clergyman of high character, whose integrity has, as it happens, been exceptionally tested.

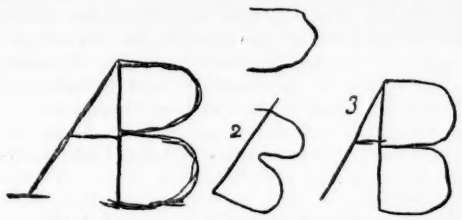
He has five daughters, of ages between eleven and eighteen, all thoroughly healthy, and as free as possible from morbid or hysterical symptoms. All these children except the youngest are able to designate correctly, without contact or sign, an object fixed on in the child's absence—not, indeed, every time, but far more frequently than probability would allow as the result of chance. The child, on returning to the room, stands close to the door, amid absolute silence, with her eyes on the ground; often she does not return, but guesses from the adjoining room, with the door closed. The children have been experimented upon at their home by the committee, by Professor Barrett, by Mr. and Mrs. Sidgwick, and by Professor Balfour Stewart, as well as at the houses of different members of the committee at Cambridge and at Dublin. The objects guessed have been chiefly cards from a full pack, and numbers between ten and one hundred, but remarkable success has been obtained, also, in guessing names chosen at random, as in the following list:—

William Stubbs: "William Stubbs."
Sophia Shaw: "Sophia Shaw."
Timothy Taylor: "Tom Taylor—Timothy Taylor."
Isaac Harding: "Isaac Harding."
Albert Snelgrove: "Albert Singrore—Albert Grover."
Tom Thumb: "Tom Thumb."
Cinderella: "Cinderella."
Chester: "Manchester—Chester."
Pipe: "Plate—paper—pipe."
Cork: "Fork."
Corkscrew: "Corkscrew."
Tongs: "Fire-irons—poker."

From the summary of results, it appears that, out of every 610 trials with playing-cards, there were 118 correct guesses on the first trial, and 76 on the second; or that,

* From the *Scientific American Supplement*.

counting the first trial only, there was 1 correct guess out of every 5·17 instead of 1 out of every 52, as would be given by chance alone. Of 260 numbers, 68 were guessed correctly the first time, and 35 the second time, or on the first trial, 1 out of every 3·82; whereas from chance would have given only 1 out of every 90. Where the trial is counted as a failure, it frequently happened that the suit, or the number of pips of the card, or one figure of the number, was guessed correctly. The partial successes, as in the guesses for "pipe" and "tongs" given above, strike us as



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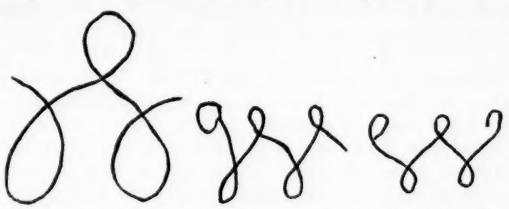
even more remarkable, and more likely to throw light upon the subject, than the complete ones. The children, when questioned, agree in saying that two or three ideas of similar objects come before their minds, and that, after a moment's reflection, they select that which stands out with the greatest vividness. Their power, instead of improving with use, has been gradually diminishing. At first, especially when they were in good humour, and excited by the wonderful nature of their guessing, they seldom made a mistake. They have been known to name seventeen cards right in succession.* Their gradual decline of power somewhat suggests the disappearance of a transitory pathological condition. On the other hand, a larger number of good subjects has been found than there was reason at first to look for.

Much more remarkable than experiments with cards or numbers, where there is at least an appreciable chance of getting right by accident, are those in which an impression of a drawing is conveyed from one mind to another, without contact or any conceivable use of the ordinary means of communication. In these experiments, Mr. Blackburn, an associate of the society, who is described as a very painstaking and accurate observer, is the operator; and Mr.



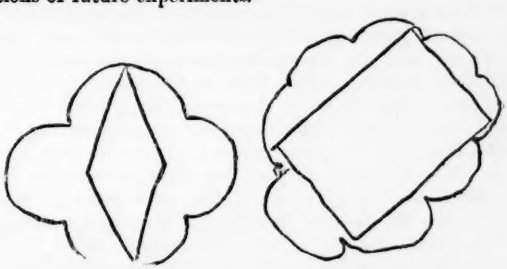
Original. Reproduction. Original as Mr. Blackburn remembered it.

Smith, a young mesmerist of Brighton, is the subject. Mr. Smith is seated, blindfolded, at a table in one of the rooms of the society; paper and pencil are within his reach, and a member of the committee is seated by his side. Another member of the committee leaves the room, and outside the closed door draws some figure at random. Mr. Blackburn is now called out, the door is closed, and the drawing is held before his eyes for a few seconds. Closing his eyes, Mr. Blackburn is led back into the room, and placed, standing or sitting, behind Mr. Smith, at a distance of some two feet from him. After a brief period of intense mental concentration on Mr. Blackburn's part, Mr. Smith takes up the pencil, and, amid the absolute silence of all present, reproduces as nearly as he can the impression he has received. Mr. Blackburn keeps his eyes closed (sometimes they are bandaged as an aid to concentration); and he has not touched Mr. Smith, and has not gone in front of him, nor in any way within his possible range of vision, since he re-entered the room. Sixty pages of the drawings and reproductions are given—facsimiles of the originals, from which they have been photographed on the wood blocks. The reproductions are rude copies of the

Original. Reproduction.

Mr. Smith had no idea that the original was not a geometrical diagram. He added line *b* some time after he had drawn line *a*, 'seeing a line parallel to another somewhere.'

drawings such as a child might make, blindfold, of a picture he had just seen; but in every case the resemblance is recognisable, and sometimes it is very exact. A particularly good one was made, when, with a view of removing all doubt as to possible auditory communication, Mr. Smith's ears were stopped with putty, a bandage was tied round his eyes and ears, a bolster-case was fastened over his head, and over all was thrown a blanket, which enveloped his entire head and trunk; and Mr. Blackburn sat behind him as still as it is possible for a human being to sit who is not concentrating his attention on keeping motionless to the exclusion of everything else. To profit by a code of signals in this case, Mr. Smith would have had to extract the putty from his ears, and still smothered in bolster-case and blanket to detect periodic variations in Mr. Blackburn's breathing imperceptible to the committee, and to interpret them into a description of a very irregular figure. This hypothesis seems to the committee an extreme one, but they intend to meet it by still further varying the conditions of future experiments.



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The record is given of another set of experiments made upon two young ladies at Liverpool, under the strictest conditions, by Mr. Guthrie and Mr. Birchall. The following were among the guesses:—

A gold cross: "It is yellow—it is a cross."
An egg: "Looks remarkably like an egg."
A penholder, with thimble inverted on the end: "A column, with something bell-shaped turned down on it."
Letter Q.: "Q."

* The chance of doing which, by accident, is as 1 to 52^{17}.

A dark-crimson apple: "It is round—a dark-red shade—like a knob of a door?"—"It is an apple."

A key: "A little tiny thing, with a ring at one end, and a little flag at the other, like a toy-flag." Urged to name it, replied, "It is very like a key."

A pair of scissors standing open and upright: "It is silver?"—"No: it is steel."—"It is a pair of scissors standing upright."

The usual phenomena were obtained by the committee on mesmerism, but with the utmost precaution against collusion and fraud. The cases which do most to stagger a cultivated scepticism are those in which the subject remains in a perfectly normal condition, with the exception of *local* effects produced on him without contact, and without any possibility of expectation on his part. The following experiment was repeated thirty or forty times without a single failure. The subject was blindfolded and seated at a table on which his ten fingers were spread out before him. A screen formed of thick brown paper quadruply folded was placed in front of him, extending far beyond him in all directions. Two of his fingers were then selected by one of the committee, and slightly pointed out to the mesmeriser, who proceeded to make very gentle passes over them; and, to prevent the communication to the subject of a sensation of change of temperature or a current of air, a member of the committee made, as nearly as possible, similar passes over two others of his fingers. After a minute or less, the two fingers mesmerised proved to be perfectly stiff and insensible; the points of sharp instruments might be plunged deep into them, or a lighted match might be applied to the sensitive region around the nail, without producing a sign or a murmur.

It is difficult to suppose that an ordinary youth, sitting with relaxed limbs in quiet unconcern, would be able to control, by the exercise of his will, every sort of reflex start or twitch when a naked flame is applied to one of the most sensitive parts of his person. To meet such an objection, however, the experiments were repeated with other subjects with equal success—one of them a delicate woman, whose shrinking from pain was such that the prick of a fork on one of her unmesmerised fingers would cause a half-hysterical cry. The hands of the subject may even be mesmerised when he is in the mesmeric sleep; and then the usual clap and call restore him to consciousness, but do not permit him to remove his hands from the sofa, to which they seem to be glued, until after they have been separately released.

We pass over the report of the Reichenbach committee, of the literary committee, and of the committee of haunted houses, but not because they do not contain a great deal of very interesting and striking matter. The addresses of the president, too, are models of clear, careful, and forcible writing; and the proceedings, as a whole, cannot fail to produce a strong effect upon a reasonably unprejudiced reader, especially when it is considered that all this is in addition to the varying amount of testimony and experience that has been for years in the possession of nearly all of us. In no other subject has there been such a long dispute over the reality of the phenomena; even the witnesses to globular lightning have gained credence for themselves at last. No other subject, as is perfectly natural, has been so inextricably mixed up with fraud and chicane, and has fallen, in consequence, under such a weight of obloquy. There has usually been, besides a peculiarly "unwashed" flavour about the possessors of these mysterious powers which are denied to people in general. The travelling mesmeriser has not been an attractive specimen of humanity, and to that fact has been allowed more than its due effect. In other undecided scientific questions, weight of authority has counted for something, but not the weight of a man's family connections. Even when it was said that such unexceptionable witnesses as De Morgan, and Wallace, and Crookes had become convinced that certain facts not generally admitted were really facts, one could not help believing that they differed in some way from the ordinary sane scientific man, and that some peculiar crookedness of mental vision was the source of their strange belief. Another refuge of incredulity has been national and sectional distrust; it was chiefly outside of the centres of learning that such things went on. Mr. Sidgwick was once told by a German, that they happened only in England or America, or France or Italy, or Russia, or some half-educated country, but not in the land of *geist*. If this society does not at once convince all the world of the truth of its phenomena, it has at least accomplished the feat of suddenly elevating them into the region of respectability; and hereafter any one can admit his belief in them without shamefacedness. Now that mesmerism and mind-reading have ceased to be exclusively the property of travelling shows and after-dinner entertainments, and have become a subject of experiment in laboratories, it is to be hoped that their extent and limitations will be speedily defined, and that the vagueness and haze in which they have hitherto been enveloped will soon be replaced by definite knowledge.

BRITISH SEASIDE RESORTS.

FROM AN UNCONVENTIONAL POINT OF VIEW.

By Percy Russell.

(*Continued from p.* 317.)

I STATED in my initial paper that the total coast-line of England and Wales approximated nearly to two thousand miles, or a fourth of the diameter of the globe. If, however, we add to this the still more sinuous coast-line of Scotland, we shall find that the length reaches 2,700, obviously very greatly in excess of England, a country double the size of Scotland; and if, again, we add for the very indented coast of Ireland over 2,000 miles more, it will be perceived that to thoroughly explore the very irregular coast-line of these islands is nearly equivalent, in point of extent, to a direct journey across half the world at the equator!

The character of all coast-lines naturally depends on the geological formation of the land itself. Wherever immense masses of mountain offer a hard front to the sea, there the coast must necessarily be bold and wild, with great headlands, and probably promontories. If the shore, however, lies low, and is composed of soft alluvial deposits, then the tide will generally hollow a bay, more or less crescent in form, and a broad and strong river flowing through such flat land to the sea is sure to produce estuaries: while if the water comes from mountains that terminate only with the shore, we have the fiords of the Norwegian peninsula or the great sea-lochs of Scotland.

The shore of North Britain, abounding in deep indentations, and having on its western side a large number of precipitous, rocky islands, tells its own wild story of elemental warfare, and of the strenuous endeavours of the stormy seas of the north to cut not only into but through the land. Indeed, so numerous are the creeks, bays, and Firths, that in no part of Scotland is the sea more than forty miles away.

The aspect of the shores varies greatly on the east and west. On the latter side we find great mountain masses stretching out at sea into grim peninsulas of terrible rocks, and having a great many openings, long, but narrow, in which the sea rushes with the form of a river and the

force of the ocean. On the east, the coast-line is very much shorter, and the character of the land is much less harsh. Sandstones and clays abound, and, although some of the cliffs are mountain-like, the aspect of the shores is infinitely less wild and romantic, and there is an absence, too, of those islands which form so prominent a feature on the west. To some extent, indeed, we have here much of the contrasts found between the shores of western England, Wales, and the eastern counties; but in Scotland it is much more marked, as we here enter a zone of fiercer tempests and of wilder storms, while the sapping action of frost is, of course, much more marked.

From the Solway Firth to the terrible and appositely-named Cape Wrath, the coast is swept by the Atlantic, and, in a great measure, protected by the various great islands and groups of islands which, in fine and warm weather, imparts an indescribable charm to our own archipelago, which, if it wants the historic associations of the isles of Greece, possesses undoubtedly very great beauties of its own, and not a few majestic memorials of the historic past.

The Solway Firth and the Firth of Clyde are both remarkable for beauty, but the latter is in many respects unsurpassed. Passing seawards from Greenock, in the distance may be discerned the grand amphitheatre of the Argyllshire and adjacent mountain opening ever and anon into stupendous gorges, between which the sea flows into many a far-off Highland vale.

Right out in the Firth of Clyde lies Arran—a mass of mountains and heath, and soaring northwards into singularly grand, jagged peaks. The culminating point is Goatfell, known in Gallic as Gaoth Bheinn, or Beinn Ghaoith—in other words, the Wind Mountain, a well-merited name, and forming something like a pyramid 2,865 feet high. Down the sides of this great land and sea mark are the wild, picturesque, beautiful glens of Rosa and Sannox, and at the foot is Brodick Bay. The principal harbour is Lamlach Bay, the best, perhaps, on the Forth, and having very good hotel accommodation. In the vicinity may be seen a mass of fine columnar basalt, a thousand feet high; and southwards are some good waterfalls, one fall a hundred feet high. South-east lies Kildonan Castle, and all along these stately basaltic formations are huge caverns, in one of which, tradition says, Robert the Bruce lay concealed a considerable time.

Geologically, Arran is full of special interest, as here may be seen, and easily too, a greater succession of strata than in any other region of the United Kingdom of like area. Devonian sandstone, trap-rocks, carboniferous strata, silurian rocks, and oolite, may all be studied to great advantage, and beside all this grandeur of rock and precipice, there are many sheltered fertile spots of singular beauty. Rivers, properly speaking, there are none, but the mountain torrents are numerous, and one of them makes a splendid leap into the sea of 300 feet over a perfect precipice. Various antiquities abound. There are plenty of cairns, monoliths, and Druid remains, and in the ruins of Loch Ranza Castle may be seen what was a residence of Scotland's ancient Kings.

The Mull of Cantyr forms another remarkable feature of this wild and romantic coast. It is a promontory forming the extreme end of a peninsula some forty miles long, and, in places, only half a mile wide, and reaching to within nearly twelve miles of the Irish coast. Then comes Islay, westward still, with its spine of mountainous hills, rising from 800 to 1,500 feet high, and its great distilleries, which give a special character to this region; and passing Islay we reach the noble Firth of Lorn, which, sheltered from much of the fury of Atlantic gales by the great island of Mull, corresponds to the vast Moray Firth of the east coast, and, ultimately, contracts into Loch Linnhe, which, in its turn, narrows into other lochs.

Mull, after the Isle of Skye, is the largest of all the Inner Hebrides, and includes great part of Argyllshire, while off its western extremity lies the most famous, in many respects, of all the western isles of Scotland, Iona—which is believed, by the way, to have obtained its name through the mistaken reading of *n* for *u*, the original word *Ioua*—the island; further yet out in the Atlantic is Staffa, that wondrous table-land, with its steep cliffs, its basalt columns and extraordinary caverns, the most famous being, of course, Fingal's Cave, with its mighty nature-built arch, its ocean floor flashing strange lights against the calcareous stalagmite of the marvellous roof.

Scott, some of whose poetry has been called, with a contempt that is, in reality, very great praise, a guide-book to the Highlands, alludes to this part of the west coast in a well-known passage, where he speaks of—

> Ulva dark and Colonsay,
> And all the group of islets gay
> That guard famed Staffa round.

Let it not be supposed that the word "gay" is merely inserted for the sake of rhyme. There is reason, too, and, set in the bright sunny seas of summer, few places in Great Britain are more worthy to be called gay. On Iona, for example, the land is so fertile that barley, sown prior to June 15, is ready for the sickle in August, and, in the dark ages, the prolific crops reaped from these western islands, whenever the inhabitants bestirred themselves, were generally held as miraculous testimonies to the holy labours of St. Columba in these wild and barbarous regions.

Mull is triangular in form, and has an area of 237,000 acres. The surface is chiefly mountainous, and there ar many lakes, while Ben More rises to the height of 3,185 ft. There is much fine moorland, and woods exist in the north; but during the fierce gales that blow over from the Atlantic, it is not, it must be confessed, quite the place for ordinary tourists.

The Hebrides, or Western Islands, are really the Ebudæ of Ptolemy, and were first colonised, it is said, in the ninth century from Norway. The Gulf Stream greatly mitigates what would otherwise be a rigorous climate, and snow rarely lies long on the ground near the sea-level. The Islands number nearly 500, but not more than 130, at most, are inhabited, and the entire area has been roughly estimated at 3,000 square miles. In few places, if any, in the three Kingdoms is such sublime and imposing scenery to be found. Skye, which in Gaelic is expressively called *skianach—i.e.* winged—presents a most remarkable appearance against the horizon. The Coolin mountains stretch from north-east to south-west, and soar up into the lofty peak of Scoor-nan-Gillean, 3,183 ft. above the sea-level. Here is to be seen the famous Loch Coruisk, which is nearly walled in by mountains 3,000 ft. high. Justly, indeed, does Scott speak of "Skye's romantic shore, where Coolin stoops him to the west." Glen Sligachan is often cited as being the grandest glen in all the Highlands, and between Loch Staffin and Rhu-nam-Brarin the coast is marked by a splendid series of fine basaltic formation, which, in reality, surpasses the Giant's Causeway or Staffa even, but which is, popularly speaking, even now little known. These magnificent cliffs are interrupted by many beautiful waterfalls and abound in caves, besides the historic cavern, near Portree, which sheltered Prince Charles. The only drawback to the full enjoyment of these lovely islands of the western coast of North Britain arises from the frequent heavy mists and rains; but in fine weather the tourist

will feel that he who has not seen the Hebrides knows not the principal mountain beauties of the British isles.

The Orkney Islands, divided from the north of Scotland by the tempest-scourged Pentland Firth, have a much milder climate than is popularly ascribed to these far-away regions. The Gulf Stream even here exercises considerable thermal power, and for a series of years the mean temperature of even January and February has been no lower than 39°. The rocks, which form the prominent features of these strange islands, are of the Old Red Sandstone formation, except only in a granitic district near Stromness. The group numbers about seventy islands, and, as in the case of the Hebrides, many of them are uninhabited. Some of the islands are low, and the steep cliffs generally rise to the west, and the heights of Hoy are justly reckoned as among the most remarkable sea-cliffs in all Scotland. The Shetland Islands, over a hundred in number, are far away in the terrible North Sea, fifty-six miles north of the Orkney group. They are for the greater part simply heaths, forbidding and inexpressibly dreary, fenced as well as they need be against the terrible Atlantic gales by giant cliffs.

Returning again to the mainland from Duncansby Head to Cape Wrath, the shores present much the same wild, rugged front, cleft by deep fissures, and jutting out wherever the cliffs are hardest, into grim, fortress-like promontories. The east coast is chiefly noticeable for the Moray Firth and the Firths of the Tay and Forth. The Moray Firth is a great indentation of the German Ocean; another estuary of the Tay forms with it the two great striking features of the east coast, until proceeding south we reach the famous Firth of Forth—the great estuary of the River Forth, which lies between the counties of Clackmannan, Perth, and Fife, on the north; and those of Sterling, Linlithgow, Edinburgh, and Haddington on the south. Close to Tantallon Castle the Firth is fifteen miles wide, and it encloses the isle of May, the historic Bass rock, and receives into its broad waters some of the most famous of Scotch rivers. The most fertile and richly-cultivated lands in Scotland lie along its shores, and the whole region is rich in romance and history.

I have specified some of the great headlands of the coasts of Scotland, but not all; and I here give a list of the principal, which, taken alphabetically, are, —Ardnamurchan Point, in the west of Mull; Buchan Ness, Aberdeenshire; Cape Wrath, Sutherlandshire; Duncansby Head, Caithness; Dunnet Head and the Ord, in the same county; Fife Ness, the eastern extremity of Fifeshire; Kinnaird Head, Aberdeenshire, north of Buchan Ness; Mull of Cantyre, already mentioned; and the Mull of Galloway. Then there are Tarbet Ness, north of the entrance to the Moray Forth, and Whiten Head. On the extreme south-east, St. Abb's Head marks the first headland of Scotland north of the English shore.

Such are the salient natural features of the physical geography of North Britain, taking a very rapid and slight survey of the coast generally. It is impossible but that such a swift flight should be in many ways full of omissions. Much that is worthy of great detailed notice has been unavoidably passed over with, perhaps, a word of allusion. This remark applies indeed to the general sketch given of the shores of England on the west. The object of the writer will be fully gained, however, if some readers are induced by these papers to seriously consider the question whether, before seeking foreign shores for the picturesque, the new, and the grand, they have really made themselves familiar with the many beautiful and, in some cases, extraordinary features of their native coasts.

(To be continued.)

Reviews.

SOME BOOKS ON OUR TABLE.

Handbook for the Dominion of Canada. Prepared for the Meeting of the British Association at Montreal, 1884. By S. E. Dawson. (Montreal: Dawson Bros.) 1884.—Although this capital handbook is stated to have been prepared for this year's meeting of the British Association at Montreal, it happens, fortunately for the reviewer into whose hands it falls so late, that its interest is scarcely of the ephemeral character which its title would seem to indicate. In fact, Mr. Dawson has produced a guide-book which will prove invaluable to the Canadian traveller after the memory of the visit of the British Association to the Dominion shall have become but dim and faint. The history, geology, botany, and meteorology of Canada are all discussed. The fullest details as to railways, steamers, and other modes of conveyance given; numerous plans for excursions furnished; full descriptions of the chief cities and towns given, with hotel charges, cab fares, lists of churches, restaurants, and amusements, &c.; in fact, everything that is necessary to enable the tourist to visit the country with pleasure, profit, and economy. The maps are very good.

An Important Question in Metrology, &c. By Chas. A. L. Totten, M.A., 1st Lieut. 4th U. S. Artillery. (London: Trübner & Co.).—It is really pitiable to find a man possessing a certain amount of ability, like Mr. Totten, wasting precious time in the way involved in the compilation of such a book as that before us. For he is one of those Pyramid fanatics, who find in the great Tomb and Observatory at Ghizeh, an inspired canon of weights and measures for all time. The way in which he juggles with figures, suggests the familiar feat of keeping a number of knives and gilt balls in the air all at once; which, glittering and flashing before the eyes of the spectators, appear to be multiplied by twenty. A single example, taken at random, will suffice to show the physicist how utterly untrustworthy our author is in the most simple of his facts. Opening his book at p. 98, we find him alleging that the mean height of the atmosphere is 5·2414828 miles! Did he, we ask in some wonder, ever hear of twilight, of meteorites becoming incandescent on entering our atmosphere, or of the aurora borealis? The characteristic feature of the whole of the farrago before us, however, is what—for want of a better name—we must term its "cock-sureness." Mr. Totten knows the mean density of the earth better than Baily or anyone else, and is familiar with her dimensions within a hair's-breadth. May we venture to recommend him carefully to read the recent address of his illustrious countryman, Prof. C. A. Young, to the American Association for the Advancement of Science, whence he may gather that we do *not* yet know the size and shape of our globe with anything like rigid accuracy. He is very severe, in places, upon Mr. Proctor, whom he invites to disprove certain assertions; intimating in effect that if the conductor of this journal does not straightway refute them they must perforce be true. We would humbly submit that Mr. Totten himself might not be able at once to offer disproof that the inhabitants of Venus subsist on Bacon's "Novum Organum" and stewed eels, but that such disability would hardly afford irrefragable evidence that the dwellers (if any) in the planet of Love were so nourished. The whole work is a saddening example of the *circulus in probando.*

Our Insect Allies. By Theodore Wood. (London: Society for Promoting Christian Knowledge. 1884).—We may commend Mr. Wood's pleasantly-written and very

readable little book to all—and they are but too many—who regard insects merely as things to be knocked down, trodden on, crushed, or otherwise killed as soon as may be. For the interested reader of his pages (and we venture to predict that every reader of them will be interested) will learn what real and enduring service is rendered to mankind by many despised and insignificant creatures, which he has probably heretofore only regarded as pests and nuisances, and objects for immediate destruction. In successive chapters Mr. Wood treats of burying-beetles and their kin; the blow-fly, and the flesh-fly; dor beetles and their work; scavengers of the water; "blight" and its enemies; predaceous insects; wood-boring beetles and their allies; and in a "Miscellaneous Chapter," of various other insects. This little volume is suited to readers of all ages, and will be perused with pleasure and profit by every one who opens it.

The Eton French Translator. Selected by H. Tarver. (London: Edward Stanford. 1884).—M. Tarver has, in the work before us, made a capital selection of very heterogeneous extracts from various French writers, for translation into English. They are of all degrees of difficulty—from the simplest narrative prose to the most technical and idiomatic descriptive writing. The advantage of this to the student will be appreciated by all who are familiar with the present mode of conducting examinations in French for military and civil appointments.

Farewell Discourses delivered at South Place Chapel, Finsbury, London. By Moncure D. Conway, M.A. (London: E. Waller. 1884.)—The seven sermons or discourses which make up Mr. Conway's volume were seemingly those with which he concluded his ministerial career at South Place Chapel. That they are absolutely heterodox goes without saying. That they are eloquent, interesting, and very readable is equally undeniable; and that they contain many a pregnant passage calculated to stimulate thought and inquiry, the reader will speedily discover for himself. He may, though, be warned that Mr. Conway never hesitates about treading upon the theological or social corns of anybody whatever.

The Origin of Man. By Edward B. Aveling, D.Sc. (London: Progressive Publishing Company. 1884.)—When Dr. Aveling confines himself to the purely scientific aspect of the evolution of man, we have nothing whatever to say against his little pamphlet. On the contrary, as a *précis* of the cumulative proofs of human evolution it leaves little to be desired. But he is not content with leaving his indisputable facts to speak for themselves; he must needs interlard his exposition with small sneers at what an immense majority of mankind hold as sacred. No better illustration of the pettiness of these could be given than that afforded by the fact that the name of the Deity is spelt with a small "g"! Were the blot to which we refer removed, his little book might be confidently recommended.

Landlords' Rights and Englishmen's Wrongs. By Alfred McDonnell. (London: W. Reeves.)—Here is another of the "Whole-hog" type of disputants, who, in common with the Vegetarians, Anti-Vaccinators, Teetotallers, *et id genus omne*—imagines that carrying out his own "fad" is all that is needful to secure the lasting happiness and prosperity of society in this country. His assertion that land (and we would here confine ourselves to agricultural land) does not bear its due share of taxation, will be estimated in its true light by all those who know how the charges for roads, police, education, the relief of the poor, &c., &c., fall one and all on the land. Should Mr. McDonnell live until land in England ceases to be private property, Methuselah will be a baby to him!

Miscellanea.

The Metropolitan Asylums Board is advertising for tenders for lighting by electricity the three hospital ships now moored in the River Thames at Long Reach, near Dartford, and the Administrative buildings on shore. The specification has been prepared by Dr. J. Hopkinson, F.R.S.

M. Mueseler's and M. Marsaut's safety lamps have been pronounced by the Committee of the Midland Institute to be, when fitted with "bonnets" or protectors, the only safety lamps which are perfectly safe under all conditions. The results published have been determined with currents of fire-damp moving with a velocity of thirty-five feet per second.

The Queen has been pleased to accept a copy of the new edition of the work entitled "Pottery and Porcelain: a Guide to Collectors," by Mr. Frederick Litchfield, the well-known expert in London pottery. That the book has come as a boon to collectors of old china is proved by the fact that since its first publication by Messrs. Bickers & Son, in 1880, two editions have been called for.

To remove ink-stains from carpets, Bœttger recommends the use of a concentrated solution of sodium hypophosphite. Recent stains should be thus easily removed, old ones must be rubbed with the solution for some time. For old ink-spots, the carpet may be moistened with hot water (and, if convenient, kept over boiling water, and finely-powdered oxalic acid rubbed upon the spot). Ammonia water should be in readiness, and the acid neutralised, if the original colour of the carpet is affected. In the case of marking-ink stains, the fabric may be soaked in a solution of calcium chloride and rinsed in ammonia water.

Snow-Water Impurities.—Under the heading of "The Beautiful Snow," the *Microscope* points out the kind of organic impurities found in snow, which, added to what we recently quoted on the same subject, very conclusively shows the fallacy of the idea that melted snow forms a good substitute for distilled water. The impurities are as follows: Living infusoria and algæ, bacilli and micrococci, mites, diatoms, and great numbers of fungi spores; also fibres of wood, mouse hairs, pieces of butterfly wings, skin of larvæ of insects, cotton fibres, pieces of grass, epidermis, pollen grains, rye and potato flour, grains of quartz, minute pieces of roofing tile, and bits of iron and coal!

The Royal Courts of Justice were to be reopened on Friday, the 24th inst., but the electric light was not ready for use on that day. It had been expected that the new machinery for generating the current, in the course of erection under the Central Hall, would be completed in time, and consequently the entire plant previously in use was disposed of and removed by the Office of Works; but it was afterwards discovered that it would be impossible to set the new machinery in motion until some weeks had elapsed after the reopening of the Courts, so that the Central Hall, the various courts, and the corridors had to be lighted by candles and temporary lamps.

A paper was read at Montreal "On the Liquefaction of Oxygen and the Density of Liquid Hydrogen," by Professor Dewar, F.R.S. The problem of liquefying oxygen and hydrogen, and consequently others of the so-called permanent gases, having been solved by Cailletet and Pictet, the author has since been employed studying the physical characters of these gases in the condensed state. The critical pressures and temperatures at condensation have been determined, and the relation of one to the other is shown to be constant. The merits of various cold-producers that could be employed in the process were discussed. Condensed ethylene he considered the best, then condensed nitrous oxide and carbonic acid. The lowest temperature that could be obtained by carbonic acid is about 115° C., and by nitrous oxide 125° C.

The Moon Eclipse.—The discrepant reports of the appearances of the moon during the late eclipse, indicate a great difference in the local atmosphere of various places, besides suggesting puzzling questions of other kinds. At 420 feet above sea-level, in Ashdown Forest, when viewed with the naked eye, 6¼ withdrawing telescope, or good opera-glass, the shadow was smoky black; no copper tint anywhere, and the brightest parts completely blotted out of recognition. Not an outline of Aristarchus could be seen in the telescope as soon as the shadow crept over it. At this height, after the eclipse, the moon looked to the naked eye like a rather dull comet that had lost its tail.

The Song of Sixpence.—Perhaps many who often repeat "Sing a song of sixpence," have never heard this explanation of its meaning:—"The four-and-twenty blackbirds represent the twenty-four hours. The bottom of the pie is the world, while the top crust is the sky that overarches it. The opening of the pie is the day dawn, when the birds begin to sing, and surely such a sight is fit for a king. The king, who is represented as sitting in his parlour

counting his money, is the sun; while the gold pieces that slip through his fingers as he counts them are the golden sunshine. The queen who sits in the dark kitchen, is the moon, and the honey with which she regales herself is the moonlight. The industrious maid, who is in the garden at work before the king—the sun—has risen, is day dawn, and the clothes she hangs out are the clouds, while the bird, who so tragically ends the song by 'nipping off her nose,' is the hour of sunset. So we have the whole day, if not in a nutshell, in a pie."

Attitudes after Death.—On Sept. 12, 1642, Cinq-Mars (Henri d'Effiat, Marquis of Cinq-Mars, Grand Écuyer of France) was beheaded for high treason at Lyons. The official executioner having broken his leg, the job was done by a day-labourer of the town with a butcher's cleaver. He made Cinq-Mars kneel and clasp the block, which was a substantial stump of a post, firmly in his arms, and, bending his body down, placed him so that his neck was well situated on the summit of the stump. The executioner then went to his left side, drew his cleaver from a bag, and delivered a blow which all but severed the head, leaving only some of the skin of the throat, which was divided by a second blow, the executioner, for that purpose, laying hold of the head by the hair. Then he threw the head on the scaffold, but it rolled off and fell to the ground. It was remarked that between the two blows of the chopper, the body, still remaining on its knees, rose stark up against the block or post, and continued in that position until the headsman with great difficulty removed the arms from the block, to which they held the body as firmly attached as if they had been coils of rope.—"Mémoires de Fontrailles."

The Action of Moonbeams.—The cases in which moonlight has been imagined to cause blindness to persons sleeping in its beams, so far as I have seen, always relates to exposure in the open air. On bright moonlight nights there is great radiation, and consequent chill of exposed parts. Possibly the light may stimulate the eye, and make it more susceptible of injury from this cause. It cannot be affirmed that moonlight is always found injurious to open-air sleepers. For example, Mr. Washington Teesdale informs me that, during many years of surveying in India, he was in the habit of sleeping outside his tent or bungalow, often in full moonlight, and never experienced injury from it. With regard to the moon's action in promoting the decomposition of fish or meat, the fact seems established that the exposed articles do spoil, but the why must be a subject of hypothesis until accurate experiments are made. Probably the cause of the mischief is the deposition of dew containing spores of microferments. Clear skies occur when the moon is out of the way, and the light of the moon might be admitted to a bit of meat or fish and the dewfall excluded. A few careful experiments suggested by these coincidences would elucidate the matter.

An Ancient Tunnel.—The Governor of Samos, Abyssides Pasha, has at last succeeded, after years of work, in uncovering the entrances to a tunnel of which Herodotus speaks with admiration as the work of Eupalinos and Megaira, and which, according to the same authority, was built during the tenth century B.C. The tunnel, about 5,000 feet long, was intended to secure a supply of fresh water to the old seaport town of Samos, and consists of three parts. They are the tunnel proper, 5½ feet high and 6 feet wide; a canal about 5 feet deep and nearly 3 feet wide, which runs in the middle or on the side of the base of the tunnel; and the aqueduct running in this canal. The aqueduct consists of earthen pipes, each 2¼ feet long, 32 to 33 inches in circumference, the sides averaging about 1½ inch in thickness. Every other joint has a hole, for what purpose has not yet been fully explained. Mr. Stamatiades, a Greek archæologist, believes that they were intended to facilitate the cleaning of the pipes, and to make the flow of water easier. The canal is arched over, but twenty-eight manholes were provided to admit the workmen who were charged with cleaning and repairing the aqueduct. The tunnel is not quite straight, forming an elbow about 1,300 ft. from one of the entrances. This elbow, according to Mr. Stamatiades, was caused by a mistake in the calculations of the engineers, who had none of the instruments used in tunnel-building nowadays. The tunnel starts near a small water-course, which may have been quite a stream in olden times, pierces the mountain Kastri, which was formerly crowned by the fort Samos, and ends a few hundred yards trom the old town of Samos, about 10 ft. below the surface. From the mountain slope to the city, this subterranean aqueduct is protected by a massive stone structure, ending within the walls of the present convent of St. John. The preservation of this work—which is truly wonderful, considering the imperfect mechanical resources at the disposal of the builders—for nearly three thousand years is probably due to the care taken by Eupalinos, who, in all cases where the rock did not seem of sufficient firmness, lined the tunnel with several layers of brick, running on the top into a peaked arch.—*Iron.*

Our Inventors' Column.

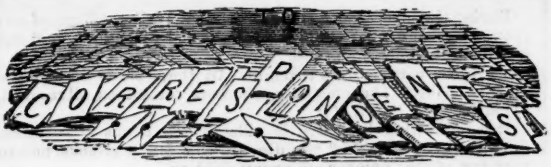
So great is the number of inventions now patented that many good things are comparatively lost in the crowd. A succinct account, therefore, by an Expert, of all inventions of really popular interest and utility must be advantageous both to the public and the Inventor, enabling persons to hear of inventions already desiderated by them, and thus acting reciprocally as a stimulant on supply and demand.

A PORTABLE SANITARY BUNGALOW.

At the late Medical Exhibition there was exhibited an interesting and seemingly a good invention, known as the Portable Sanitary Bungalow, for which some very important advantages are claimed. In the construction, rows of dwarf pillars, standing on separate stones, support a gridiron of creosoted balk girders, sustaining a platform of slate slabs, or other material. Shallow grooves in this receive the bottoms of the walls, formed likewise of slabs placed edgewise, and strengthened by inside and outside skirting, screwed together and into the floor. Similar mouldings above receive the tops of the walls, form the cornices of the rooms, and act as horizontal tie-rods. Others placed vertically divide the walls into panels, and bind them down to the foundation; the ceilings are wooden, the supporting joists form panels; these can be adjusted to the exigencies of the climate. Iron is used wherever practicable; the joints are secured by fish-plates, and by screwing home on a stay wool-packing are made air-tight. The drainage goes into a tank on wheels. It is claimed that this building is fire-proof, as there is nothing to burn, and it is damp-proof, being off the ground. In like manner it is free from vermin, and if erected on leasehold land does not revert to the freeholder; it is also virtually everlasting. The cost is stated to be very low. By increasing the height of the supporting foundation pillars good storage room can be obtained below. Further information may be had of the inventor, Mr. W. V. Brock, 82, Warwick-gardens, Kensington, W.

VENTILATED CARRIAGES.

We need no doctors to tell us how much illness, and sometimes with fatal result, is due to carriage draughts—a sort of penalty generally exacted on those who keep their own vehicles. The fact is, close carriages have no ventilation, and when shut up with tight windows are unwholesome to a degree, especially if full. Happily, a remedy for this evil has at length been found in the shape of an invention of Messrs. Hill & Sons, the well-known carriage-makers of London, Dover, and Folkestone. The invention consists mainly of a ventilating tube or shaft of a taper form, fixed immediately under the roof, from front to back, the narrowest end being in front. Along each side are arranged, obliquely, a series of apertures or air passages, which are covered at each end with sheets of fine gauze about an inch apart, so that each sheet being separated by a vacant space, intercepts any sudden rush of air that might enter the shaft, and, if not so interrupted, cause a down-draught; at the same time they allow the vitiated air to be drawn through the openings without hindrance. A small protected opening is made in front of the body of the carriage, and a larger one at the back, protected by a specially constructed metal plate, so made as to prevent wind or rain finding its way through the opening. By this arrangement and the peculiar form of the shaft, on a forward movement of the carriage, a current of fresh air passes through the shaft from end to end, and by its velocity and action tends to form a vacuum at each side aperture, causing the impure air to be sucked or drawn through the aperture into the shaft, whence it is expelled by the current of fresh air, through the widest or hind end of the shaft. For admitting fresh air to take the place of that carried off, small openings are made under the glass frames, concealed by curved shields of ornamental design to protect the occupants from draught, as well as to direct the fresh air against the surface of the windows to prevent the vapour which generally accumulates on them when the windows of a carriage are quite closed. Another great advantage is that when closing the door with all the windows up, the air, which would otherwise be compressed, escapes through the ventilating shaft, and so diminishes the concussion hitherto resulting from the sudden shutting of the door. This applies more especially to carriages where slam locks are used. The extra cost of this admirable apparatus to a new carriage is very moderate, and it is by no means large if it be required to apply it to existing carriages. At Messrs. Hill & Sons establishment, 17, Baker-street, Portman-square, London, the system can be inspected.



"Let Knowledge grow from more to more."—Alfred Tennyson.

Only a small proportion of Letters received can possibly be inserted. Correspondents must not be offended, therefore, should their letters not appear.

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No communications are answered by post, even though stamped and directed envelope be enclosed.

"THE TRUTH ABOUT KOCH'S CHOLERA GERM."

[1482]—The able and brilliant *exposé* of "official" science in Germany by Professor Ray Lankester in the *Pall Mall Gazette* of October 6 (*Pall Mall Budget*, October 10) is worthy of special note.

Dr. Robert Koch, as an official scientist, makes a "dogmatic" declaration to the effect that a certain micro-organism is the specific organism that is the immediate exciting cause of cholera. A "dogmatic" declaration this, because the chain of causation involved in the question has not been displayed in the only recognised efficient manner, that is by the "culture test." Professor Lankester delivers judgment thus:—"The pressure upon him [Koch] urging him to announce a definite result was irresistible. He has formulated such a result on the most flimsy grounds; his Government has rewarded him, and for some time official science in Germany will not dare to expose the worthlessness of his theory." Has ever before the "endowment" of scientific research faced such a crushing, even damning, indictment? A scientist having a grand record of able work done yields, according to Professor Lankester, to the "irresistible" pressure of the string-holders of the endowment-purse, under whose *ægis* he has elected to work, and formulates on flimsy grounds, and at a critical moment, a theory having possibly momentous social and international bearings. This is indeed serious, but worse follows. The debasing *ægis* of the endowment-purse is irresistible, according to Professor Lankester; for he himself does not believe there is a single fearlessly honest "official" biological microscopist in all Germany. He writes:—"For some time official science in Germany will not dare to expose the worthlessness of his [Koch's] theory." The implication is, indeed, damning to all endowment of research. The implication being that whenever an "official" scientist formulates a theory on flimsy grounds all other "official" scientists of the same nation will not "dare" to expose the worthlessness of such theory.

Whether Professor Lankester's case against Dr. Koch be good or (as for many good reasons may be hoped) bad does not affect this matter of the debasing tendency of endowments. For, obviously, his case depends on his knowledge of the tone and tendency of mind amongst European "official scientists," nearly as much as on facts. And few Englishmen are better positioned than he to have such knowledge.

Somewhat oddly, in the midst of this tremendous indictment of endowment of research, there are sandwiched three numbered paragraphs that read best if the whole article be viewed as an elaborately, solemn, cynical joke. In the first paragraph, State authorities are actually advised to undertake the study of the relations of bacteria to disease! The second paragraph contains a congratulation (that reads beautifully from the cynical joke point of view) that the Indian Government is actually "officially" investigating the cholera germ matter. And the third paragraph, a (comically cynical) warning to all on the "flimsy" "official" theory of Dr. Koch. But, read seriously, these three paragraphs have no logical connection with the rest of the article, so they may be taken for what they are worth.

Fred. W. Foster.

MIND AND BRAIN.

[1483]—Mr. Peppin is not satisfied with my answer, which, in fact, had reference only to Mr. Peppin's assertion that Büchner mistook cause for effect. But clearly, Mr. Peppin's letter (1467) shows his own uncertainty whether the thought produces the vibrations, or the vibrations thought; in fact, he puts to myself the question he had previously decided. The simile I adduced cannot, and was not meant to be, "absolutely" true. But it appears to me that in the case of transmission of light to the prism and sound to the ear, the process in both cases is purely mechanical. Further the effect of the transmission of these vibrations is in both case intangible; or does Mr. Peppin consider colour something material, that can be weighed or measured?

Whence comes the power of the brain to transform sound into thought—exactly whence the power of a prism to transform light into colours comes from; it is their innate property—in fact, it is their nature to.

In the case of the lecture, I should say that its influence, *i.e.*, the thoughts produced in our brain through the vibrations caused by the sound of speech from the will, which is certainly not independent of it.

F. W. H.

THE LUNAR ECLIPSE.

[1484]—Allow me to corroborate the testimony of M. de Boë, given in Captain Noble's letter (1451). While watching the eclipse through an 8½ in. Calver's reflector, I observed a peaked appearance exactly at the spot and the stage marked in his diagram. In my case also there was surely no illusion, since four of us all saw it distinctly, and it was noticeable with a smaller hand-telescope as well as with the larger. *Was* the moon on the horizon of the Cordilleras at that moment? A rough calculation which I made at the time seemed to show that the shadow of part of the ocean was then being cast upon her, but I suppose I was wrong. Can the appearance have been due to any peculiarity in the *atmosphere* on the horizon?

I should have described the colour during totality as dusky ashen-grey, rather than phosphorescent green.

Liphook, Hants, Oct. 21. C. W. Leadbeater.

[The calculation of the position of the Cordilleras was seemingly made by M. de Boë himself, whose mathematical attainments are quite equal to his observational powers. I have no time to recompute it.—Ed.].

[1485]—After reading what you say in a recent number, it occurs to me to say that in the "dirty white" of the moon's disc during totality, there was, as seen here, I think, a faint taint of green, but I know nothing to compare it to, except a sodden poultice of flour!

I asked Dr. Copeland, of Dunecht, what he saw, and he replies that he and his assistant were too busy watching "occultations during the total phase to permit of studying the colour of the moon. I only recollect that about the end of totality the moon's limb was of a lovely primrose colour, and that many of the markings were visible." I did not see this. Wm. Millar.

THE RECENT ECLIPSE—γ AQUILÆ—THE AFTERGLOW.

[1486]—Premising that I and two friends here—we all three obtain our own copy of Knowledge, and are therefore entitled to three votes—shall be very glad to read an account in your columns of a graphic method of predicting eclipses, I would say that we in Tonbridge saw the last eclipse splendidly. The points we noticed were:—

1. The dark aspect of the moon during totality.
2. The sharp termination of the umbra of the earth's shadow.

The constellation Aquila is very full of interest to the amateur observer, but what is the colour of γ Aquilæ? We consider it to be a dark red, but it is not marked as such in your new "Star Atlas." Our telescope was a very good achromatic, but, after neglect for some time, it is anything but a good achromatic now. Would such a defect in the telescope be sufficient to account for the red colour? We anxiously await the new maps announced in the last edition of Knowledge.

As I write, the brilliant colours of the sunset attract my attention. They have changed from pink to red; thence to a brighter golden colour, and then pink again. E. A. Tindall.

[γ Aquilæ is yellow.—Ed.]

MAY-FLIES.

[1487]—With great interest I read Mr. Butler's paper on the above. In spite of their short period of existence, I have, when fishing, observed these flies settle upon my coat and there shed their skins completely, *i.e.*, covering of wings included. At the close of the day I have been plentifully sprinkled with these whitish cast-off coverings. Is not this an exceptional peculiarity with respect to these flies? F. W. Halfpenny.

XUM

SCIENCE AND THEOLOGY.

[1488]—You mistake entirely what I mean by anti-theological. It is somewhat ungracious of me to be fault-finding, seeing that your pages have given me, in common with your many readers, so much pleasure, and that there is after all so little room for finding fault. But perhaps you will allow me to point out what I mean. It is of more importance than a mere personal explanation—it is the statement of a misunderstanding which has long existed between scientific men and theologians—a misunderstanding that in the interest of both parties ought to be cleared up. Let us take up the current number of KNOWLEDGE. I object to (as anti-theological) the assumption (p. 345) that Moses was not the author of Genesis. The question is open to debate, but we may fairly object to anyone who has not made a special study of the subject settling it for us in this off-hand style. Again, I consider it anti-theological to have so many views of works like that of Mr. Smith's (referred to in letter 1474), as if these were representative of theological literature. A religious journal might as well take the theories about the Great Pyramid and the Scientific Societies for the investigation of ghost stories as representative of the minds of the great scientists. And, again, let us take the note which you append to my letter in your last issue. Because I am a clergyman you assume that I must reject scientific doctrines which have facts and not merely testimony to appeal to. Now, as a matter of fact, I do not reject these doctrines. I can scarcely say I believe in them, for I have not given these subjects sufficient study; but, for the present, I am quite content to bow to authority and accept these conclusions if they are accepted by the majority of "scientific men who are entitled to be listened to." But when the scientific men tell me further that I am on their authority (since I have not the leisure nor the ability to make the investigation for myself) to give up all my old beliefs and hopes, then I say that they are asking too much. They are seeking to become my religious teachers as well as my scientific directors; and I most strongly object to them as the former, though I am quite ready to admit them as the latter.

I once wrote a paper on the theological aspect of Darwinism, and read it at an assembly of clergymen. It was an appeal to theologians for the independence of science. I wish I could induce you to relax your rule sufficiently to insert it in KNOWLEDGE, for it also advocates the independence of theology. Nothing can possibly be gained by a theologian telling a scientific man that he is an atheist; nor, on the other hand, should a scientist say to a theologian that he objects to scientific conclusions (particularly when he does not object) simply because they are opposed to his own views.

JOHN HEALY, CLK. LL.D.

Ballyboy Rectory, King's Co.

[Would that all theologians exhibited the impartial and judicial spirit of Dr. Healy. I venture to think, however, that he is mistaken in his view that scientific men (legitimately so-called) ask him to give up all his "old beliefs and hopes." All that men of science claim is the right to pursue their investigations untrammeled by any consideration of whither the results may conduct them; and that no thought of such results being—in theological language—"opposed to revealed religion" should be suffered for a single instant to operate in influencing decisions to be arrived at strictly by the study of evidence. That, however, which they demand for themselves, they must in common justice grant to the theologian. I am only prevented from inserting Dr. Healy's proffered essay by the certainty that it would call forth a flood of correspondence of a very pronounced anti-theological character, which I could hardly, in fairness, refuse to insert.—ED.]

VACCINATION.

[1489]—In your impression of October 10 appears a letter by "F. S." under the head of "Vaccination."

I have read it several times with the object of discovering why it was written, and have only so far been able to guess.

I can see nothing wonderful nor useful in the information that out of a family of twelve, eleven were inoculated with small-pox and only one was vaccinated. Nor do I see anything extraordinary in the fact that this one, along with two or three unfortunate clergymen, subsequently took the disease.

Although it tends to do so, vaccination does not prevent small-pox—not even in clergymen—but it does form an almost perfect safeguard against death from that disease.

In the old days inoculation produced the disease in a more or less mild form, and the subject was, of course, not liable to any recurrence; but the *deaths* from small-pox, when this was practised, increased to an alarming extent, as the *practice itself* spread the disease, everywhere creating new centres of infection.

During the months of last December to April a village of more than a thousand inhabitants was attacked by small-pox, and came prominently under my notice.

Thirty-six persons were taken ill. Of these three were unvaccinated, and died. The remainder, who were vaccinated, all recovered. (Think of that, "F. S."!)

It is interesting to notice in villages and towns attacked how sluggish is the spread of the disease, how few it attacks, and how very few of that number are young children.

Thanks to vaccination, and the fact that young children are more immediately under its influence.

W. SEEBEE.

ANOTHER FIGURE PUZZLE.

[1490]—Can you explain the enclosed problem? I cannot make it out at all. You will see there is a curious superstition connected with it, and I should be extremely obliged if you can elucidate the mystery for

LOVER OF THINGS OCCULT.

8	1490	1493	1
1492	2	7	1491
3	1495	1488	6
1489	5	4	1494

The Asiatics regard the above arithmetical problem as the most potent talisman in existence, those who wear it being supposed to have full command over demons, fairies, and enchanters.

[No, I cannot explain the "arithmetical problem," for the simple reason that I do not see the connection between the figures. Perhaps some of our readers may be more perspicacious.—ED.]

TRICYCLE TRACKS.

[1491]—In connection with this subject (the ridge left in the centre of the track when passing over a dusty road), perhaps you will kindly give me room to state a fact, not previously mentioned in your columns, as far as I have observed. The wheels of ordinary carriages leave very distinct ridges in the centre of the tracks. Of course, they have iron tires. I also found that the wheels of a perambulator, having convex iron tires, leave tolerably distinct ridges, even when driven at an ordinary walking pace. The properties of indiarubber have nothing to do with the formation of the ridges in these cases, and they can only be caused by suction, as previously pointed out by some of your correspondents.

Oct. 18, 1884.

STARCH.

THE FLIGHT, SOARING, AND POISING OF BIRDS.

[1492]—A great deal has been written on the flight of birds generally, and much labour has been expended in attempting to explain the mechanism by which such wondrous results are produced; but, as far as my reading goes, no writers have demonstrated that the great class, *Aves*, may be divided into distinct groups characterised by their *modes* of flight. Thus, I might say, we have the flappers, cleavers, flutterers, soarers, and poisers; and flapping and cleaving may be combined in the same bird, as may also cleaving and poising, and flapping and poising. By flapping, I mean the steady up and down movement of the wing in an arc, say of 45°; cleaving is the rapid movement of the pinions, as if in swimming; fluttering is a very rapid, almost invisible, flapping, and is accompanied by flight in undulations or bounds. Soaring is practised by birds with great expanse of wing, and is virtually the momentum acquired by flapping; poising is a species of flutter in which the wings vibrate rapidly, with their apices upwards.

Let us now watch a *Raptor*, say the common kite of this country, and we observe that as it sails overhead, its large spread of wings, terminating in segregate feathers, like fingers, flap leisurely up and down between the soars, and you fancy the movement ought to *raise* instead of propel the bird. Throw up a bone, and you will at once see it cleave the air with its wings, as if swimming, moving exactly as the gentle *Columbidæ* always do.

The cranes, herons, and storks all move leisurely with flapping wings, and the exertion must be fatiguing, for all rest themselves by soaring. If we turn to the flying mammals, we find propulsion effected by up and down flaps of the webbed arms, without an attempt at air-cleaving or soaring. The flying fox (*Pteropus rubricollis*) affords a familiar illustration of this leisurely mode of flight;

mynas, parrots, and starlings, which are social birds, all fly fast, and by cleaving—they never soar.

The wagtails have a jerky, cleaving flight, as if they were always winding up for a fresh exertion; it consists of dips and rises.

That singular bird the Darter or Snake bird (*Plotus anhinga*(?)), quite at home in the water, is equally at sea on the wing, flying clumsily and laboriously, and resting repeatedly in soars. Our egrets, as a rule, fly leisurely, with steady flap, but I have seen flights of them adopting the soar as well, as if the exception ran in families.

Dragon-flies flap and soar, the former when on the feed, and the latter when sunning themselves. Flying-fish both soar and flap; pea and guinea fowl flap awkwardly in rising, and soar on alighting; white ants flap in swarming. But some birds, strange to say, seem to progress by soaring, *i.e.*, apparently irrespective of momentum, and this power is exhibited in these in an astonishing manner. Take any one of the many instances I can adduce, and the phenomenon is equally marvellous.

A bright, cold-weather day, and a cobalt sky above you, and perhaps half a mile up in the cærulean, you see a couple of adjutants and half a dozen condors and vultures soaring, their keen eyes the while watching the earth. Watch the adjutant. Having lost his momentum he flaps his enormous wings once or twice and then treats you to circles and circles of soar, apparently endless, until you marvel whence his power comes. And so with his companion condors and vultures.

On one occasion I was travelling eastward by rail, and noticed an adjutant soaring towards the line, and half a mile off on my left, when he had crossed above, and I again looked out on my right, he was still soaring, and certainly had not flapped in the interval. What is this wonderful power? It is difficult to believe that a mile soar is the momentum of one or two flaps of powerful wings. It may be so, for on *good* ice you may *momentumise* a mile with a few good flaps, so to speak, of your skate-clad feet, and that, too, in the face of friction.

Then, too, these soarers have a less dense resisting medium at their favourite heights, and so a powerful flap gives a prolonged momentum. The poisers are very wonderful in their action, and are best illustrated by the kingfishers; the adjutants overcome gravity by soaring; another vastly smaller and weaker bird do so by poising, which consists of a stationary position, secured by rapid and invisible flutter-flapping, the points of the wings being directed upwards. The extraordinary thing is that, with this immense display of muscular power, they should remain absolutely stationary until the plunge; so stationary that you can cover the kingfisher with your gun for a minute or more. Another wonderful thing is its power of instantly overcoming momentum; thus, baffled in the plunge, the kingfisher will take two or three bounds in flight, *and then instantlg poise exactly at the right elevation.* Terns poise, but not so steadily and persistently as the kingfishers, nor with the same muscular action.

Other poisers are the sun-birds and moths, while probing flowers for honey, but their movements are not so striking as those of the kingfishers.

R. F. H.

LETTERS RECEIVED AND SHORT ANSWERS.

Ghost of a Little Boy. Such a slip as that of − 5 hours for +5 hours in no sense invalidates the argument of "C. R.," that for a ghost to appear at the instant of the death of its owner it must do so at a different hour in America to that at which such owner gave it up in England.—A. R. Pannett. The British Association Catalogue has been for years out of print, and is only procurable at a very high price indeed. Mr. Wesley, of Essex-street, Strand, London, would be the likeliest man to procure you a copy. I do not know where "Mädler's Comet Catalogue" is to be had, but there is a very good one in Chambers's "Descriptive Astronomy."—G. Pinnington (23, Chichester-street, Chester) should forthwith make the acquaintance of J. Murray (of Newcastle), and exchange views with him. "Pompey and Cæsar am berry much alike, 'specially Pompey."—Miss de Jersey Moore. The conductor of this journal is so dunned for his autograph that he has been reluctantly compelled to make a rule to refuse it; and regrets, extremely, that he can make no exception in your particular case.—J. B. Do you seriously suppose that the conductor of Knowledge would suffer his name to appear continually were it not true?—J. McLagan. "Physical science" is such an extremely comprehensive term that the only reply I can give to your query is the form in which it appears is: All. Lyell's "Students Elements of Geology" ought to suit you for the purely geological part of your subject, which, though, is now made a very heterogeneous one.—H. C. Halle. *Vide* letter by B.M., F.R.C.S.—William Runtz. I am wholly unable to help you. I have never heard of the person you name publishing anything but the grossest and most scurrilous abuse. See concluding paragraph (in capital letters) at the head of the correspondence columns.—F. H. "Better late than never" sends the seventieth or eightieth answer received to Mr. Sidder's Figure Puzzle.—S. E. Thornton. The best college in which you can study to become an Electrical Engineer is the School of Submarine Telegraphy and Electrical Engineering, 12, Prince's-street, Hanover-square, W.—William Millar. We need not trouble Mr. Mattieu Williams. It is merely a form of puffing advertisement. The moon was in her descending node at the time of the recent eclipse.—Veritas. I cannot undertake to answer questions which should be submitted to a solicitor. Law can only find a place in these columns in its aspect of a branch of sociology.—Fleming, Wilson, & Co. Mr. Ganga Ram's pamphlet was reviewed on p. 75 of the current volume of Knowledge.—Some Anonymous Correspondent sends me two religious rhymes utterly inappropriate to these columns, either for insertion or review.—J. Lury asks Mr. Browning to describe the various two-speed tricycle gears now in use, with their weight, mode of fixing, &c. He also seeks a definition of "a steep hill," as understood in the Eastern Counties.—J. O'Neill. Thanks. It will be utilised.—J. P. B. I know of no single cheap Encyclopædia of the comprehensive character you require. Nichols' "Cyclopædia of the Physical Sciences" is an excellent book of reference in a small compass, and I have some idea that its publishers also issued a corresponding one of the Natural Sciences. Maunder's "Treasury of Knowledge" contains a Gazetteer, a précis of history, and a mass of other information. Perhaps, though, your best plan would be to try and get a second-hand copy of the old "Penny Cyclopædia." It is a perfect repertory of information, although the Physics are not quite up to date.—Maximilian Strong. Our Lord was undoubtedly born four years before the "Anno Domini" of the calendar. Suetonius says that Tiberius was born 42 B.C.; and, as he was 54 when he became emperor, his reign must have commenced A.D. 12.—Ferrarius. Your quotation is from Pope's "Essay on Criticism." "Pierian" was an expression applied to the Muses, &c., from Pieria, a tract of country in Thessaly.—W. Stringfield. Dr. Gerber's book was sent to us for notice by the Messrs. Trübner, whose name was printed on the title-page, whence the Reviewer copied it.—L. P. asks if any of our readers have tried the Hamiltonian method, and, if so, with what results?—Henry Morley. You can no more multiply a sum of money into itself than you can trees by trees, or paragraphs by chimney-pots.—W. H. K. S. You are confusing in a very odd way "a refusal to consider evidence" with wilful unbelief. A man ignorant of evidence cannot be said, in any legitimate sense, to have any belief at all. What is meant is this. The object before me possesses the attributes of whiteness, flexibility, semi-transparency, and so on, and the sum of these I call a sheet of paper. Suppose now that you were to tell me that my salvation depended on my belief that it was really (say) a roast goose. If this were so, my damnation must be inevitable; and yet this is scarcely an exaggeration of what is often described from the pulpit as "wilful imbecility."—W. Received.—C. Carus-Wilson. I regret the blunder, for the rectification of which steps have been taken.—E. W. Young protests against the vulgarism of "don't" being used for "doesn't," in connection with a singular nominative.—T. Harrison. "Fontenelle" will be continued. I condole with you sincerely on having to listen to such stuff as that of which you send the report. The person you refer to will get no more unpaid advertisements in these columns.—C. Hunter. I regret my inability to supply Knowledge to your League gratis. If I began by doing so there are numerous associations throughout the kingdom who might equally claim to receive it for nothing.—J. M. Coates. As yours is one of several requests for a description of a graphical method of predicting a Lunar Eclipse, one shall appear in due course.—Dr. Davey. Your book shall receive attention.—Thos. Radmore. Thanks for your friendly letter. I shall always be glad of any original observations of interest.—Thos. Baugh. Certainly not. How could the subject himself, or any spectator (real or imaginary) be examined or cross-examined? Science cannot possibly deal with such a case.—W. S. C. I should scarcely think that a patent is now in existence for the mere use of asbestos in a gas fire. Gas fires are *not* "all unhealthy."—C. H. Kesteven. Doubtless the fish decomposed from radiation and moisture.—A. M. D. I have never in my life heard either of the man or of his "philosophy."—Nemesis. Shall receive immediate attention.

WHIST.—J. E. Buckbarrow. You appear to refer to (what I imagined was as dead as Queen Anne) Long Whist. With regard to the question you raise, the law was explicit: "Honours can only be called at eight points, and then *only by the player whose turn it is to play.*" The fact of his adversaries standing at nine points does not affect this rule, one way or the other.

Our Chess Column.

By Mephisto.

THE CHESS SEASON.

After a period of natural reaction following upon the excitement f the London Tournament, Chess seems to be gaining an increased hold upon the popular fancy. This conclusion is based on the all-round activity and enterprise manifest in Chess circles at the present time.

The Chess season of 1884-85 has set in. From all sides notes of martial ardour are sounded. Challenges have been issued and accepted, and the first matches have been contested. In London there are two trophies to be played for by the various local clubs, viz., the Staunton Medal, offered by Mr. Edw. Marks, and the Baldwin Hoffer Challenge Cup.

The City of London Chess Club has taken possession of new rooms at the Salutation, Newgate-street, and has arranged its annual handicap of 100 players. The Club has also challenged the St. George's Chess Club to a match of twenty players aside. This challenge has been accepted, and the interesting contest will take place on January 19, 1885. M. Rosenthal, of Paris, having paid a visit to this country, has played 24 members of the Norwood Chess Club simultaneously, and has also given similar performances at Manchester. Zukertort has made his first public appearance in this country after his return from America by playing 24 members of the City Club. We believe the Club has made arrangements for similar exhibitions by other players.

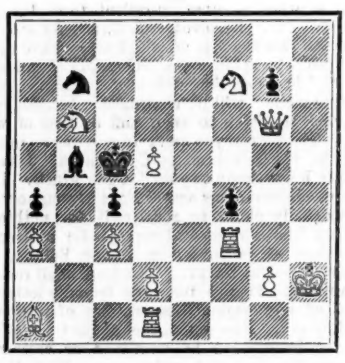
Reports from the provinces announce the meeting of the Surrey, Sussex, Sheffield, Yorkshire, and Scottish Chess Associations, also of various other Chess clubs, all reports show signs of increased vitality and vigour. The great event up North will be the match between Yorkshire and Lancashire, which will be played at Manchester on Nov. 8. The competing teams will be composed of 160 players. Finally we hope to see the newly-formed British Chess Association show signs of life this season, and thus contribute its share to rendering the next few months—what to all appearances they will be—productive of enjoyment and recreation to Chessists.

PROBLEM No. 134.

By F. Healey.

(A problem that will never lose its charm nor fade from our memory.)

Black.



White.

White to play and mate in three moves.

SOLUTION.

Problem 132, by W. Furnival, p. 330.

1. R to KR sq. !	P × P, or	1.	P to R4
2. B × P	K × B (*a*)	2. B to B sq.	P moves
3. R to R5 mate		3. B to B4 mate	

(*a*) if K to B3

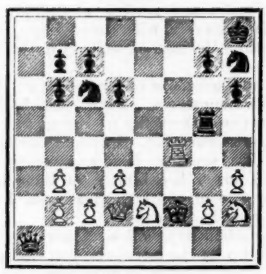
3. Kt to B5 mate

The following interesting termination occurred in a game recently played at Gatti's between two strong players.

Position after Black's 19th move.

Mr. Weightman.

Black.



White.

Mr. Laws.

The game proceeded as follows:

White.	Black.
20. Q to K3	R to K4
21. Q to B3	Q × P

(It will be well to remember that taking the opponent's QKtP in the middle of the game, mostly puts the Queen out of play—as in this case, a frequent source of danger.)

22. Kt to Kt4	R to K sq.
23. R to K4	R to KB sq.
24. Kt to B4	Q × P (ch)
25. K to Kt3	

(White is playing a bold but deep game; he has some sinister designs on the Black R by Kt to Kt6 (ch), or maybe he is trying to compose a problem.)

	K to Kt sq.
26. R to QB4	

(With the object of gaining Q5)

	Q × KtP
27. Q to Q5 (ch)	R to B2
28. Q to K6	P to QKt4
29. Q to Kt6	

(A powerful stroke, threatening destruction by Kt × P (ch), K to R sq., Kt × R (ch), &c.)

	Kt to K4

(This looks very good; it is, however, of little use. If 29. K to B sq. 30. Q × Kt, P × R. 31. Kt to Kt6 (ch), K to K sq. 32. Q to Kt8 (ch), K to Q2. 32. Q × R (ch), &c., would be equally bad. Now White forces the game in an ingenious and vigorous manner.)

30. Kt × P (ch)	K to B sq.
31. Kt to K6 (ch)	K to K sq.
32. Kt × KtP (ch)	K to Q sq.

(K to B sq. would only have delayed the issue for a few moves.)

33. Kt × R (ch)	Kt × Kt
34. Kt to K6 (ch)	K to K sq.
35. Q to Kt8 (ch)	K to Q2
36. Q × Kt (ch)	K to B sq.
37. Q mates.	

ANSWERS TO CORRESPONDENTS.

*** *Please address Chess Editor.*

Correct solutions received:—M. T. Hooton, A. E. R., W. Parker, Geo. W. Thompson, John Watson, S. B. B., A. W. Cunard, W. H. W. Sherrard.—Thanks.

W. Parker.—*The Chess Players' Chronicle.*

Problem, No. 133, by B. G. Laws, p. 352.—This problem admits of several solutions, and is therefore incorrect.

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